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SOILS OF THE MANAWATU DISTRICT.

PART III. THE LOAMS AND OTAKI SANDS.

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IN Part I of these articles the recent dune-sands, consisting almost wholly of mineral matter and crystalloid in character, were described, and in Part II an account was given of the humus soils, formed almost wholly of organic matter and chiefly colloidal in character. In this part it is intended to deal with the loams, which do not suffer from the conspicuous defects of the previous types and therefore represent the most valuable soils of the area, and the older dune-sands named by Dr. Cotton the "Otaki sand series," which have been so altered in character and surroundings that they do not offer the same difficulties in treatment which the recent dunes do in conversion to pasture or arable land.

Owing to the large amount of space which a presentment of the analytical evidence entails this article will be restricted to a description of the types dealt with, leaving to a later date the full consideration of the data which are here collated. No difficulty was experienced in separating the previous types dealt with. A hand-and-eye examination of the most superficial character is sufficient to separate

the dune-sands from the peats, or to say whether they have been mixed. When dealing with the loams it will be necessary to exercise much more caution, for they may merge into the humus soils, the sandy soils, or the clay soils—or would do so if any such be present. In no soil, however, was an amount of clay found which would entitle a sample to be called a clay soil, although perhaps some of the subsoils might merge into clays. Exactly how to classify the soils treated of in this article can be determined only by a careful mechanical separation of the constituent particles into different grades of fineness by means of sieves and settlement in a column of water, and by determining the relative amounts of the differently sized particles present. In this way it has been possible to classify the loams in the following classes and groups :—

Silt Loams, Group 1.—This contains the heaviest type of soil met with in the district, the samples being all similar in the proportion of the different kinds of sediments present. The silts vary from 48 to 52 per cent., the sands from 25 to 27 per cent., and the clay from 10 to 16 per cent. Coarse sand is never present in amounts higher than 4 per cent. Much of the land bordering the Manawatu River is this class of country, and the material may have been largely derived from the eastern or Wairarapa side of the Tararua Range. Chemically, all the soils of the type examined in the vicinity of this river were, with the exception of a forest soil, found to be deficient in available and total phosphoric acid, but the potash was present in quantity. The hillside soils of Waikanae suffer from the same defect—want of phosphates. The Paekakariki soils of this type are, however, well provided with phosphate and carbonate of lime.

Silt Loams, Group 2.—The soils of this group are closely related to those of Group 1, but contain less of the silt fraction and more coarse sand and clay. Generally speaking, they are richer in available plant-food.

Sandy Loams.—As the title denotes, these soils contain a higher proportion of sand, the coarse sand varying from 4 to 33 per cent., the total sands being from 45 to 53 per cent., and the percentage of silts about 25 per cent., while the clay is about 10 per cent. Chemically they are all, except one or two, deficient in available and total phosphoric acid, but are well supplied with total and available potash. Those which owe their sandy nature to an admixture of the Otaki sandstone are invariably deficient in phosphates.

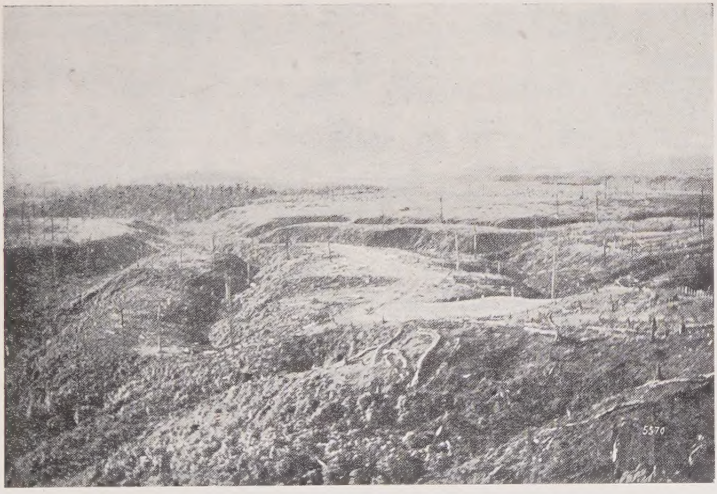
Otaki Sands.—These soils are the easiest type to define of those dealt with in this article. They are derived from the old Otaki sandstone, first described and named by Dr. Cotton, and are distinguished by containing a large amount of coarse sand—from 30 to 40 per cent.—the total fine and coarse sand making the greatest proportion of the soil—roughly 60 to 70 per cent.—and with very small quantities of silt and clay. Chemically they are deficient in both available and total phosphoric acid, but well supplied with potash.

NOTES ON SOILS ANALYSED (SEE TABLES).

K 265. — Collected (24/8/18) on Arapaepae Road, Kimberley, Block V, Section 14, Waiopehu Survey District (Buller Es . . Greywacke detritus on Otaki sandstone. Down in pasture.

VIEW AT PAEKAKARIKI, LOOKING INLAND FROM DIRECTION OF MODERN FIXED SAND-DUNES.

In background the Tararua Mountains, which contribute the hillside soils, and the fan-lands in middle ground, eroded by sea-action into cliffs. In foreground is a marine plain and ancient swamp from which samples L 419, 420, 422, and 424 were collected. [*Photo, C. A. Cotton.*



AREA OF OTAKI SANDSTONE (ANCIENT DUNE) COUNTRY AT SHANNON.

This area is much eroded by streams, but capable of supporting forest, as shown by the stumps. Now in surface-sown pasture. Representative of samples K 375, K 492, and L 436. [*Photo, G. L. Adkin.*

K 268.—Collected (24/8/18) on Block V, Section 38, Waiopehu S.D., from pasture land adjoining Ohau Bridge, near Rolleston's Creamery, 35 ft. to 40 ft. below the level of the previous terrace, on land originally formed by the Ohau River. This is a flat terrace carrying good pasture, with many stumps of black-pine still remaining, denoting rich soil. Much timothy and white clover present. This is typical of much of the newer river-terrace land of the Manawatu district on which dairying is carried on.

K 269A.—Collected (24/8/18) on Waiopehu Native Reserve, in a gravel flood-plain of the Ohau River. Taken to a depth of 4 in. to 10 in.; a shallow soil on gravel. Totara the dominant forest-tree, with underscrub of *Melicope simplex*, mahoe, hinau, *Myrsine Urvillei*, *Pittosporum tenuifolium*, *Myrsine salicina*, and manuka. Rape and turnips do well on this land where deep enough to plough.

K 270.—Collected (24/8/18) at Ohau Village, Block V, Section 14, Waiopehu S.D. Unploughed land on greywacke detritus on Otaki sandstone. Pasture: cocksfoot and rye-grass now deteriorating or "going out." Similar in character to K 265.

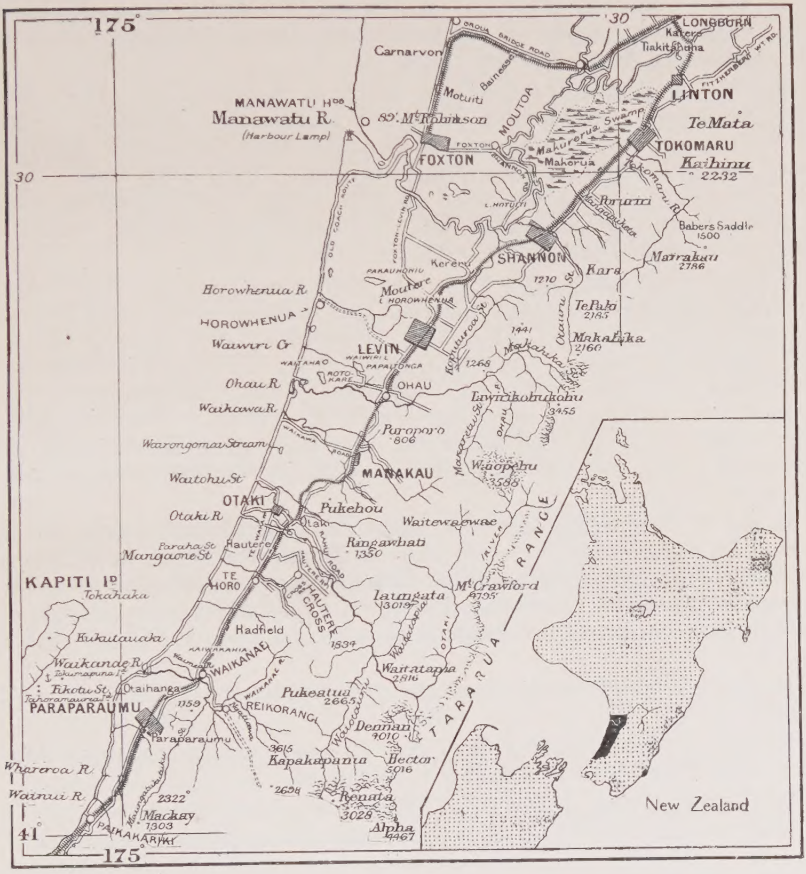
K 272A.—Collected (24/8/18) on Arapaepae Road, between Kimberley and Levin, Block I, Section 4, Waiopehu S.D. Unploughed rough stump country, with a pasture of cocksfoot and rye-grass, now going out and reverting to Danthonia pilosa and Poa pratensis. Suckling-clover is common, and moss is abundant. This area is typical of a large area of Manawatu country—very flat, and resting on a gravel subsoil. The original forest-trees were tawa and totara, with lesser forest of titoki, mahoe, and rewarewa (*Knightia*). Soil stony and subsoil gravelly.

K 273.—Collected (24/8/18) on top of terrace, 215 ft. above sea-level, near hills, Block XIV, Section 11, Mount Robinson S.D. This terrace is on Otaki sandstone, but being nearer the Tararua foothills the greywacke detritus is very deep, and it was not found possible to reach the sandstone with the sampler, although the sandstone is well shown in a road-cutting leading to the top of the terrace. Sample taken from Tully's Farm, on the top of the terrace, consisting of some of the finest rye pasture in the district, with a high white-clover content. The pasture has been down fourteen years, and its excellent state is perhaps in part due to its being used for fattening store cattle rather than for dairying, for which latter it is suitable, and which would have resulted in a greater draft on the soil-phosphates. Forest originally tawa chiefly, with occasional pukatea, except in the swampy hollows, where it was more abundant. The underscrub was mahoe, *Hedycarya*, *Pennantia*, and much supplejack, which latter is usually regarded as an indication of good soil. The higher lime-content when compared with surrounding soils will be noticed.

K 277. — Collected (25/8/18) on Block XIII, Section 2, Mount Robinson S.D., Foxton Road, on Otaki sandstone, 300 ft. above sea-level. Land opposite Levin golf-links, undulating, dissected by square-sided gullies, down in pasture many years but never ploughed; no sign of stumps. Pasture consists of crested dogstail, rye-grass, white clover, and Yorkshire fog, with hummocks of Danthonia pilosa. Many weeds present, chiefly *Ranunculus parviflorus*, and rushes (*Juncus effusus*) plentiful. Originally forest, as in K 273.

K 280.—Collected (25/8/18) on Block XIII, Mount Robinson S.D., Native reserve. This sample was taken in similar country to last in an area nearer the junction of the Otaki sandstone with the recent blown sand from the coast—a grassed paddock which has been ploughed.

K 372.—Collected (21/9/18) in land near Otaki Railway-bridge, on a gravel flat supporting a light scrubby vegetation. The dominant shrubs



MAP OF DISTRICT DEALT WITH IN THIS SERIES OF ARTICLES.

Scale, 10 miles to the inch. Inset map shows relative locality.

are titoki and *Melicope simplex*, but also present are *Podocarpus totara*, which may have been more plentiful in the past (being removed for fencing), *Myrsine Urvillei*, *Olea Cunninghamii* (maire), *Melicytus ramiflorus*, *Myrtus obcordata*, with occasionally a stunted rimu or matai. The sward of native grass in the interspaces is chiefly composed of *Microlena stipoides* (New Zealand rice-grass). Other plants present were *Muehlenbeckia australis*, *Passiflora tetrandra*, *Astelia Solandri*, *Asplenium flaccidum*, *Earina mucronata*, *Pseudopanax crassifolium*,

Dodonaea, Cordyline australis, Pittosporum eugenioides, Coprosma crassifolia, Rubus australis. Block IX, Section 9, Waitohu S.D.

K 373.—Collected (21/9/18) at Pahiku, on Te Waka Road, Block VIII, Waitohu S.D., on Otaki sandstone. This road runs along the edge of a scarp of Otaki sandstone. The soil rests directly on the sandstone as a subsoil. The soil is low in available and total phosphoric acid. This land grows lucerne well, indicating that phosphoric acid is not so necessary for this crop.

K 375.—Collected (21/9/18) at Pahiku, Te Waka Road, Waitohu S.D. Taken on portion of paddock where Otaki sandstone comes to the surface and forms the soil itself.

K 380.—Collected (21/9/18) on Block V, Kaitawa S.D., from fan-land, Waikanae; compound of recent shingle and detritus. Fans similar in slope to that on which Duncan's stud farm rests (situated about one mile north of the railway-station). Very stony land. Soil taken in many places from 2 in. to 7 in. deep. Now down in good English grasses, spotted medick, &c. Formerly covered with "coastal" forest, kohekohe (*Dysoxylum*) being the dominant tree.

K 387.—Collected (23/9/18) in the Esplanade Gardens, Palmerston North, in virgin forest of tawa, pukatea, and white-pine, with small forest and underscrub of titoki, kawakawa (*Piper*), lacebark (*Hoheria lanceolata*), *Shefflera*, mahoe, *Coprosma grandifolia, C. robusta*, wineberry, *Geniostoma, Aristotelia racemosa, Hedycarya*, ferns, and epiphytes, the characteristic habitat of *Adiantum formosum*, which is abundant here. This terrace land on the banks of the Manawatu River must be accounted a rich soil, and is typical of much of the terrace land near Palmerston North.

K 389.—Collected (23/9/18) on high terrace land about 100 ft. above level of Palmerston North, south bank of Manawatu River, Main South Road, three miles from Palmerston. This is heavy land which previously supported tall forest, as shown by the stumps, which now persist on the surface-sown pasture. Pasture poor, becoming invaded by rushes and moss.

K 391.—For full particulars see previous article in last month's *Journal*, p. 63.

K 395.—Collected (23/9/18) in pasture above Otaki sandstone, four miles from Palmerston North, near Tokomaru.

K 401.—Collected (23/9/18) in pasture near Koputaroa.

K 403.—Collected (23/9/18) in forest near Manakau, consisting of tawa, pukatea, and some rimu, with underscrub of mahoe, hinau, kohekohe, *Schefflera, Hedycarya, Geniostoma*, fuchsia, *Solanum aviculare*, ferns, lianes, and epiphytes.

K 488, &c.—These are ten samples of soil taken (3/1/19) from the different paddocks of the Central Development Farm, Weraroa, for the purpose of making an intensive study of the farm soils. The averages are here given as sufficient for the purposes of this article. The soils varied little in composition, and the paddocks have all been cultivated and manured, and have been used chiefly for dairy-farming for a number of years. The original vegetation was tawa forest.

K 491.—Collected (30/12/18) on Heights Road, at 650 ft., in poor pasture which has reverted to danthonia. Greywacke hillside soil.

K 492.—Collected (30/12/18) on Heights Road, at 350 ft., in Otaki sandstone. The similarity of this soil to that taken near sea-level on the same sandstone (see K 375) is remarkable.

L 419.—Collected (19/9/19) on greywacke hillside with gentle slope, at Paekakariki (Lynch's). Subsoil, greywacke gravel. Pasture contains many rushes.

L 420.—Collected (20/9/19) in paddock on west side of railway-line, north of Paekakariki Railway-station, on flat growing excellent rye-clover pasture—on site of old swamp containing a few stumps. Pasture a close sward.

L 422.—Collected (20/9/19) on flat near Paekakariki, on pasture. Soil probably derived from both dune-sand and hillside detritus.

L 424.—Collected (20/9/19) in long flat paddock of arable land on McKay's Farm, Paekakariki. Down in Western Wolths rye-grass; previous to this turnips, which had been fed off.

L 426.—Collected (20/9/19) on flat area of mixed dune-sand and hillside detritus on McKay's land, Paekakariki. From the stumps extracted, was probably in the past a swampy forest; now highly farmed land.

L 431.— Collected (20/9/19) in dense forest (Hadfield's) at Paraparaumu. Forest of kohekohe, pukatea, and tawa, with underscrub of nikau-palm, kiekie (*Freycinetia*), kawakawa, climbing-ratas, *Muehlenbeckia australis*, mahoe, supplejacks, *Parsonsia*, *Geniostoma*, rewarewa, "lawyer," ngaio, and titoki.

L 435.—Collected (20/9/19) on hillside, Waikanae Forest: kohekohe, tawa, with underscrub similar to that of L 431, but subsoil stony.

L 436.—Collected (20/9/19) in kohekohe-pukatea forest, on Otaki sandstone, Waikanae.

L 438.—Collected (20/9/19) in hillside mahoe forest, Waikanae, in very stony soil with bare floor. Other trees, &c.: kohekohe, tawa, titoki, rimu, nikau, *Hedycarya*, pukatea, kiekie, tree-ferns, and mixed shrubs. Gravel subsoil.

L 443.—Collected (21/9/19) on terrace above Otaki Township, near Waitahou Valley Road, in tawa-pukatea forest, with usual underscrub.

L 445.—Collected (22/9/19) in manuka-clad terrace near the Ravenswood Cheese-factory. Vegetation consists of manuka (*Leptospermum scoparium*), with much moss and a little poor pasture in interspaces. Only other scrubs, *Coprosma robusta*, *C. propinqua*, *C. areolata*, and *Olearia virgata*, which all occur sparingly in the manuka scrub.

L 499.—Collected (5/10/19) in hillside forest, Waikanae, in kohekohe-pukatea-tawa forest, with usual underscrub, at elevation of 250 ft. Tatton Fraser's property.

L 501.—Collected (5/10/19) in upland pasture (largely danthonia), Waikanae. In similar position to L 499, Tatton Fraser's Farm. This area is very similar to a large area of fan-land, including the well-known Gear Estate. Originally covered with coastal forest.

L 503.—Collected (5/10/19) on same hillside, lower down. This pasture—English grasses and clovers—has been down thirty-five years, and is at present in excellent condition.

MANAWATU DISTRICT SOILS (LOAMS AND OTAKI SANDS).—CHEMICAL ANALYSES.

Results except * are percentages on soil dried at 100° C.

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1-per-Cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Lime-requirement (Percentage $CaCO_3$).	
		* On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	On Air-dried Soil.	On Soil dried at 100° C.
	Silt Loams, Group 1.														
K 387	Palmerston North: Forest	13·1	8·74	7·91	0·302	0·198	0·060	0·047	0·033	0·88	0·65	0·61	0·14	0·13	0·14
K 389	Ravensworth: Surface-sown pasture	26·6	2·58	8·02	0·292	0·086	0·032	0·031	0·005	0·54	0·25	0·32	0·06	0·17	0·18
K 391	Ravensworth: White-pine forest	27·8	3·54	9·12	0·300	0·096	0·039	0·034	0·009	0·58	0·28	0·22	0·05	0·22	0·23
K 395	Tokomaru: Pasture	31·8	2·98	7·87	0·252	0·109	0·038	0·026	0·004	0·65	0·30	0·23	0·05	0·16	0·17
K 401	Koputaroa: Pasture	15·7	7·54	9·60	0·240	0·142	0·047	0·035	0·004	0·60	0·36	0·24	0·05	0·14	0·15
L 420	Paekakariki: Pasture	24·0	5·24	17·12	0·570	0·229	0·053	0·037	0·027	0·82	0·90	0·84	0·14	0·45	0·47
L 424	Paekakariki: Western Wolths rye pasture (contains $CaCO_3$)	7·8	5·70	10·90	0·322	0·250	0·051	0·062	0·075	0·80	0·66	0·82	0·21	0·18	0·19
L 445	Ravensworth: Manuka land	10·5	7·40	7·80	0·245	0·063	0·048	0·021	0·005	0·53	0·22	0·24	0·07	0·25	0·27
L 501	Waikanae: Hillside pasture	22·6	3·52	8·37	0·276	0·153	0·070	0·036	0·008	0·57	0·52	0·48	0·02	0·14	0·15
L 503	Waikanae: Hillside pasture	24·0	3·48	7·99	0·273	0·173	0·072	0·035	0·011	0·75	0·62	0·45	0·10	0·10	0·10
	Subsoils.														
K 388	Subsoil of K 387	12·9	2·32	3·70	0·103	0·126	0·042	0·034	0·028	0·76	0·82	0·53	0·08	0·11	0·11
K 390	Subsoil of K 389	29·4	3·62	5·05	0·131	0·060	0·040	0·029	0·002	0·51	0·33	0·36	0·04	0·14	0·15
K 396	Subsoil of K 395	30·4	2·64	4·89	0·112	0·080	0·013	0·027	0·002	0·61	0·47	0·31	0·03	0·11	0·11
K 402	Subsoil of K 401	24·3	5·08	6·03	0·145	0·063	0·039	0·031	0·001	0·29	0·44	0·14	0·02	0·19	0·20
L 421	Subsoil of L 420	19·6	3·84	8·49	0·207	0·190	0·058	0·032	0·020	0·79	1·13	1·08	0·13	0·21	0·22
L 425	Subsoil of L 424	26·8	3·86	11·49	0·288	0·192	0·041	0·042	0·016	0·60	0·80	0·67	0·12	0·33	0·34
L 446	Subsoil of L 445	20·8	2·82	5·14	0·147	0·050	0·049	0·025	0·002	0·49	0·46	0·41	0·03	0·16	0·16
L 502	Subsoil of L 501	24·0	2·42	5·10	0·135	0·064	0·070	0·028	0·002	0·38	0·65	0·48	0·03	0·15	0·15
L 504	Subsoil of L 503	23·5	2·72	5·12	0·144	0·097	0·072	0·028	0·002	0·53	0·81	0·50	0·05	0·13	0·13
	Silt Loams, Group 2.														
K 265	Kimberley: Pasture	18·0	6·98	13·15	0·353	0·156	0·043	0·029	0·012	0·79	0·60	0·30	0·12	0·22	0·24
K 269A	Ohau River: Small forest and scrub	39·3	4·62	13·19	0·348	0·198	0·059	0·040	0·006	0·51	0·66	0·53	0·04	0·21	0·22
K 272A	Kimberley: Surface-sown pasture	48·4	20·22	18·12	0·113	0·080	0·024	0·020	0·007	0·45	0·58	0·34	0·09	0·34	0·43
K 273	Levin: Pasture	14·7	12·46	11·01	0·318	0·247	0·069	0·039	0·009	1·00	0·57	0·36	0·11	0·12	0·14
K 380	Waikanae: Pasture	57·3	7·72	19·74	0·192	0·248	0·088	0·056	0·034	0·87	0·63	0·76	0·11	0·31	0·34
K 403	Manakau: Forest	22·0	15·78	17·00	0·581	0·296	0·085	0·037	0·027	0·84	0·68	0·36	0·18	0·19	0·23
L 431	Paraparaumu: Dense coastal forest	15·9	3·70	9·34	0·308	0·096	0·071	0·024	0·011	0·47	0·33	0·42	0·06	0·27	0·28
L 438	Waikanae: Dense coastal forest	31·3	9·14	22·69	0·641	0·470	0·113	0·091	0·029	0·64	..	0·60	0·16	0·24	0·26
L 499	Waikanae: Hillside forest	25·0	3·70	8·29	0·253	0·131	0·077	0·036	0·005	0·58	0·64	0·44	0·05	0·17	0·18
K 488	Weraroa Central Development Farm: Pasture and arable (average of 10 paddocks)	14·7	7·20	11·74	0·274	0·197	0·055	0·041	0·013	0·74	0·64	0·35	0·12	0·19	0·20

	Subsoils.														
K 266	Subsoil of K 265	20·0	7·88	8·88	0·249	0·078	0·027	0·025	0·009	0·53	0·59	0·29	0·06	0·23	0·25
K 267	Subsoil of K 265	43·0	3·60	6·37	0·183	0·040	0·014	0·023	0·007	0·56	0·73	0·37	0·06	0·19	0·20
K 274	Subsoil of K 273	15·0	3·26	5·35	0·162	0·090	0·035	0·027	0·001	0·54	0·67	0·33	0·06	0·12	0·12
K 404	Subsoil of K 403	27·7	10·64	9·22	0·272	0·083	0·039	0·025	0·008	0·58	0·86	0·47	0·16	0·17	0·19
L 432	Subsoil of L 431	14·4	2·12	4·55	0·123	0·072	0·042	0·018	0·002	0·37	0·41	0·48	0·05	0·16	0·16
L 500	Subsoil of L 499	20·6	2·64	5·15	0·130	0·045	0·041	0·020	0·002	0·40	0·73	0·49	0·03	0·24	0·25
K 488	Subsoils of same Lab. No. (average of 3 paddocks)	14·4	5·82	7·24	0·132	0·073	0·043	0·012	0·005	0·59	0·74	0·36	0·10	0·19	0·20
	Sandy Loams.														
K 270	Ohau: Surface-sown pasture	17·5	10·96	10·60	0·296	0·099	0·038	0·039	0·006	0·81	0·39	0·23	0·07	0·19	0·21
K 277	Foxton Road: Surface-sown pasture ..	22·9	6·10	12·01	0·321	0·260	0·073	0·055	0·008	0·92	0·51	0·26	0·11	0·12	0·12
K 372	Otaki Bridge: Small forest and scrub ..	24·7	9·12	15·50	0·516	0·221	0·062	0·045	0·005	0·57	0·39	0·41	0·03	0·14	0·15
K 373	Te Whaka Road: Pasture	29·7	3·48	7·75	0·245	0·128	0·042	0·030	0·004	0·49	0·38	0·32	0·05	0·13	0·14
K 491	Heights Road: Danthonia pasture	8·0	10·41	8·62	0·224	0·109	0·045	0·024	0·004	0·29	0·40	0·32	0·03	0·15	0·16
L 419	Paekakariki: Hillside pasture	17·1	2·90	8·87	0·295	0·137	0·043	0·039	0·006	0·53	0·47	0·36	0·06	0·18	0·19
L 422	Paekakariki: Flat pasture	12·5	5·04	21·15	0·662	0·250	0·036	0·022	0·017	1·12	0·37	0·32	0·08	0·54	0·57
L 426	Paekakariki: Flat arable (contains $CaCO_3$) ..	37·0	8·84	19·26	0·580	0·385	0·038	0·049	0·052	1·25	0·36	0·38	0·18	0·25	0·27
L 443	Otaki: Forest	20·0	2·76	7·32	0·242	0·186	0·073	0·033	0·019	0·43	0·40	0·54	0·16	0·13	0·13
	Subsoils.														
K 271	Subsoil of K 270	12·5	8·40	6·55	0·147	0·035	0·015	0·020	0·006	0·52	0·50	0·24	0·02	0·18	0·20
K 272	Subsoil of K 270	13·3	3·54	5·16	0·110	0·022	0·010	0·010	0·005	0·53	0·57	0·27	0·04	0·23	0·24
K 278	Subsoil of K 277	10·9	6·96	6·53	0·190	0·109	0·040	0·036	0·004	0·37	0·41	0·14	0·06	0·11	0·12
K 374	Subsoil of K 373	18·9	2·42	4·81	0·150	0·082	0·042	0·022	0·002	0·44	0·54	0·35	0·03	0·17	0·17
L 423	Subsoil of L 422	22·6	3·76	5·57	0·146	0·126	0·032	0·012	0·015	1·29	0·42	0·30	0·07	0·10	0·10
L 427	Subsoil of L 426	40·6	3·62	10·46	0·282	0·098	0·040	0·016	0·009	0·89	0·51	0·47	0·10	0·23	0·24
L 444	Subsoil of L 443	27·6	3·00	8·45	0·228	0·146	0·053	0·028	0·010	0·38	0·92	0·61	0·11	0·09	0·09
	Sandy Soil.														
K 268	Ohau Bridge: Surface-sown pasture	21·6	2·92	8·86	0·292	0·203	0·041	0·030	0·025	0·61	0·69	0·64	0·16	0·14	0·14
K 269	Subsoil of K 268	16·2	4·26	5·96	0·183	0·156	0·034	0·020	0·020	0·48	0·75	0·82	0·02	0·08	0·08
	Sandy Soils (Otaki Sandstone Sands).														
K 280	Foxton Road: Pasture	16·4	4·94	8·89	0·257	0·142	0·031	0·054	0·006	0·57	0·44	0·25	0·07	0·16	0·17
K 375	Pahiku, Te Whaka Road: Pasture	16·6	1·92	5·85	0·228	0·162	0·054	0·078	0·007	0·49	0·23	0·20	0·03	0·07	0·07
K 492	Arapaepae, Heights Road: Pasture	13·5	4·72	6·59	0·174	0·138	0·047	0·023	0·003	0·56	0·27	0·20	0·01	0·08	0·08
L 436	Waikanae: Forest	67·3	5·04	8·03	0·283	0·192	0·085	0·049	0·009	0·80	0·40	0·27	0·08	0·04	0·04
	Subsoils.														
K 281	Subsoil of K 280	11·7	5·34	5·56	0·124	0·048	0·018	0·027	0·003	0·44	0·40	0·20	0·04	0·21	0·22
K 282	Subsoil of K 280	13·3	2·94	4·37	0·084	0·036	0·015	0·020	0·003	0·46	0·40	0·22	0·04	0·18	0·19
K 376	Subsoil of K 375	8·8	1·44	3·16	0·091	0·086	0·038	0·021	0·005	0·30	0·31	0·21	0·02	0·07	0·07
L 437	Subsoil of L 436	11·9	3·94	6·20	0·192	0·082	0·056	0·037	0·004	0·34	0·40	0·17	0·05	0·09	0·09

MANAWATU DISTRICT SOILS (LOAMS AND OTAKI SANDS).—MECHANICAL ANALYSES.

Results are percentages on air-dried soil.

Lab. No.	Description of Soil. (Classification of U.S. Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.						Stones and Gravel.
		Fine Gravel.	Coarse and Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
K 387	Silt loam	Nil	25·5	32·7	15·5	11·7	16·0	..
K 389	Silt loam	,,	27·9	40·7	11·4	12·5	10·4	..
K 391	Silt loam	,,	26·1	37·7	14·7	10·3	12·3	2·1
K 395	Silt loam	,,	36·0	30·4	11·2	11·8	10·6	10·7
K 401	Silt loam	,,	30·9	32·7	10·0	10·6	16·4	4·3
L 420	Silt loam	,,	15·2	30·8	16·3	16·0	21·5	..
L 424	Silt loam	,,	21·1	37·3	6·3	19·5	16·0	..
L 445	Silt loam	,,	29·4	34·8	11·4	10·7	14·6	..
L 501	Silt loam	,,	27·2	35·2	12·2	12·7	11·6	..
L 503	Silt loam	,,	27·1	26·9	11·9	12·2	11·2	..
K 388	Subsoil of K 387: Sandy loam	,,	45·8	26·7	11·6	10·1	5·9	..
K 390	Subsoil of K 389: Silt loam	,,	31·4	34·8	11·0	15·0	8·5	..
K 396	Subsoil of K 395: Silt loam	,,	34·7	31·5	12·1	15·8	7·4	20·0
K 402	Subsoil of K 401: Silt loam	,,	29·2	33·6	11·6	15·8	10·8	11·1
L 421	Subsoil of L 420: Silt loam	,,	17·8	32·6	14·4	23·3	12·0	..
L 425	Subsoil of L 424: Silt loam	,,	18·9	26·3	12·9	28·0	14·9	..
L 446	Subsoil of L 445: Silt loam	,,	34·6	31·7	11·9	15·4	7·8	..
L 502	Subsoil of L 501: Silt loam	,,	27·2	35·2	12·2	12·7	11·6	..
L 504	Subsoil of L 503: Silt loam	,,	27·1	36·9	11·0	12·2	11·2	..
K 265	Silt loam	,,	27·6	24·5	10·8	5·5	19·2	..
K 269A	Silt loam	0·5	30·6	23·5	10·9	17·7	17·2	..
K 272A	Silt loam	1·2	20·2	25·6	3·7	11·0	31·7	..
K 273	Silt loam	Nil	26·1	31·7	10·0	12·2	22·1	..
K 380	Silt loam	,,	23·9	24·5	12·2	12·8	25·9	26·4
K 403	Silt loam	,,	24·4	28·3	8·9	9·0	30·1	6·0
L 431	Silt loam	,,	30·0	31·4	12·0	14·4	12·7	...
L 438	Silt loam	,,	29·0	21·8	9·8	11·8	29·8	8·3
L 499	Silt loam	,,	31·1	33·2	12·0	13·4	11·7	8·1
K 488	Average of 10 paddocks	..	34·2	24·5	12·8	10·1	16·5	..
K 266	Subsoil of K 265: Sandy loam	Nil	42·0	22·5	9·9	8·9	16·1	..
K 267	Subsoil of K 265: Sandy loam	,,	52·1	19·3	9·7	7·6	9·7	..
K 274	Subsoil of K 273: Silt loam	,,	30·4	29·1	15·2	18·7	8·4	..
K 404	Subsoil of K 403: Silt loam	,,	21·2	31·2	13·3	15·6	18·9	7·5
L 432	Subsoil of L 431: Silt loam	,,	37·4	29·7	11·3	15·6	6·6	4·0
L 500	Subsoil of L 499: Silt loam	,,	33·5	28·8	12·2	18·9	7·7	..
K 488	Average of 3 paddocks (subsoil)	..	31·7	31·0	11·0	19·8	10·9	..
K 270	Sandy loam	Nil	45·9	16·0	8·7	9·3	20·4	..
K 277	Sandy loam	,,	48·6	18·8	6·9	6·3	17·4	..
K 372	Sandy loam	,,	50·7	20·3	9·4	9·7	11·0	..
K 491	Sandy loam	,,	45·6	16·8	10·8	8·5	16·4	..
L 419	Sandy loam	,,	47·4	24·6	10·0	9·0	11·5	3·2
L 422	Sandy loam	,,	41·4	12·6	11·8	9·1	25·1	..
L 426	Sandy loam	,,	51·5	9·2	6·9	8·4	26·4	..
L 443	Sandy loam	,,	47·4	24·0	7·4	11·7	9·9	..
L 271	Subsoil of K 270: Sandy loam	..	51·1	15·3	8·0	11·2	14·4	..
L 272	Subsoil of K 270: Sandy loam	..	60·9	14·6	7·9	6·8	8·5	..
K 278	Subsoil of K 277: Sandy loam	Nil	52·3	15·5	9·7	9·1	13·0	..
K 374	Subsoil of K 373: Sandy loam	,,	52·7	15·5	10·2	14·9	7·1	..
L 423	Subsoil of L 422: Sandy soil	,,	71·9	8·6	5·3	6·3	9·1	..
L 427	Subsoil of L 426: Sandy soil	,,	64·5	6·2	4·3	12·4	13·7	..
L 444	Subsoil of L 443: Silt loam	,,	44·6	27·0	10·1	10·0	11·2	..
K 268	Sandy soil	4·7	60·7	12·2	8·5	2·9	8·6	..
K 269	Subsoil of K 268	0·4	39·3	28·5	9·5	10·5	9·3	..
K 280	Sandy soil	Nil	60·2	11·7	9·3	6·2	13·4	..
K 375	Sandy soil	,,	71·0	9·7	8·0	4·5	7·7	..
K 492	Sandy soil	,,	60·6	13·1	10·2	5·4	9·8	..
L 436	Sandy soil	,,	58·5	15·5	6·7	7·0	12·7	..
L 281	Subsoil of K 280: Sandy soil	,,	64·4	9·6	7·0	8·6	10·7	..
L 282	Subsoil of K 280: Sandy soil	,,	71·8	5·9	9·0	7·4	7·2	..
L 376	Subsoil of K 375: Sandy soil	,,	75·2	8·8	4·2	6·4	5·0	..
L 437	Subsoil of L 436: Sandy loam	,,	57·1	14·9	8·9	9·9	9·9	..

NOTE.—Illustrations in this article by courtesy of New Zealand Institute.

(To be continued.)

Pinus insignis for Hive-making.—Last season at the Ruakura Apiary insignis-pine timber was tried as a substitute for native white-pine in the making of hives, frames, &c. The results have been quite satisfactory.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

HEMLOCK (*CONIUM MACULATUM* L.).

ESMOND H. ATKINSON, Biological Laboratory.

SPECIMENS of hemlock have been received for identification from several widely separated localities during the past year, with the information that it was suspected of poisoning stock. An account of the plant will, therefore, not be out of place in this series of articles.

DESCRIPTION.

Hemlock is a tall biennial herb reaching a height of from 2 ft. to 5 ft. in the flowering season, with a stout tap-root rather like that of a dock or a parsnip, which penetrates deeply into the soil.

The stem, which is hollow throughout its length except at the nodes or joints, and much branched above, is as thick as the thumb, or thicker at its base, rather obscurely marked with longitudinal grooves, and in its ground-colour bluish-green, owing to the presence of a delicate bloom like that on a plum. The most conspicuous feature of the stem, however, is the presence of numerous purplish-red spots, which are scattered irregularly over its surface, usually becoming more abundant towards its base.

The stalks of the lower leaves are a foot or so in length, hollow, and about as thick as the stems, which are clasped by their broad expanded bases. These leaf-stalks are spotted like the stems, so thickly, indeed, that the whole basal part of the stalk is often stained a uniform purplish-red, giving it an appearance not unlike rhubarb. The lower leaves are several feet long, including the stalk, and are roughly triangular in outline. The leaf is what is known as compound —namely, one composed of a number of secondary leaves, which in this case are borne in opposite pairs on either side of the main axis of the leaf, and are themselves several times again divided in a similar way. The ultimate divisions are sharply pointed, and from their extreme number and fern-like delicacy make the whole leaf a very graceful one. The leaves borne on the upper part of the stem are very similar to the lower ones, but are much smaller and less divided, and have shorter stalks.

The flowers of hemlock are arranged in what are called umbels, an umbel consisting of a main flower-stalk, from the apex of which arise, all from the same point, a number of secondary stalks or rays spreading so as to form a flat-topped or rounded head. Each of these rays bears either a single flower, when the umbel is said to be a simple one, or another much smaller umbel, the whole inflorescence being then called a compound umbel. The umbels of hemlock belong to the second of these two classes, and are from 1 in. to 3 in. in diameter. At the point of insertion of the primary rays are several bracts,

variable in number, while at the base of each secondary umbel are three others turned outwards, this arrangement of the bracts being peculiarly characteristic of hemlock. The flowers themselves are small, with five white petals. They need not be further described, as they are very similar to those of a number of allied species and are of little importance in the identification of the plant.

The flowers are pollinated by insects, and each flower develops into two fruits, which have appearance of seeds and are popularly known as such, though in reality each is a one-seeded fruit, the enclosed seed filling most of the interior and being comparable to the kernel of a peach-stone. Each fruit is about $\frac{1}{8}$ in. long by $\frac{1}{10}$ in. broad, and more or less flat on one face and strongly convex on the other, the convex face bearing five slightly waved longitudinal ridges. The fruits are arranged in pairs with their flat surfaces together, and when fully ripe are suspended by their upper ends from the top of a slender stalk which lies between them and is the elongated axis of the flower. At this stage they are of a warm grey colour with a faint tinge of fawn.

Hemlock seeds freely, and seedlings may generally be found in all stages of development where the weed is at all plentiful. The seed-leaves are rather long and narrow, and are faintly veined above; they are soon followed by the first finely cut foliage leaves. The spotting so characteristic of mature plants is not apparent for some time, but as a rule quite small seedlings have their leaf-stalks and stems more or less deeply stained with purplish-red or pink.

All parts of hemlock have a peculiarly strong and disagreeable smell, which in the case of the dried plant is decidedly mouse-like, while in the living plant it is faintly suggestive of fennel and several allied species, though not quite like any of them.

PLANTS SIMILAR TO HEMLOCK.

Hemlock belongs to the large and very distinct family *Umbelliferae*, which, besides including several very poisonous plants, contains a number useful to man in various ways. The chief edible species are the carrot, parsnip, celery, and parsley, while others such as fennel, caraway, &c., are used for flavouring and other purposes.

The genus *Conium* comprises only two species (or a single one according to some authors), but several of the allied genera include plants superficially not unlike hemlock, and in view of the poisonous nature of the latter it is important that the differences between them should be known.

The leaves have been mistaken for those of parsley, with fatal results; but their greater size, more sharply pointed ultimate segments, peculiar smell, and spotted or stained stalks should be sufficient to enable any one but the most unobservant to distinguish between the two plants. Cases of poisoning have also occurred through the roots being eaten in mistake for parsnips; but the large and broad segments of the leaves of parsnip are entirely different from the feathery leaves of hemlock.

The fruits or "seeds" of aniseed (*Pimpinella Anisum*) are very like those of hemlock, and commercial lines of aniseed have from time to time been observed to be contaminated with them. The larger

HEMLOCK (CONIUM MACULATUM L.).

(A) Base of stem; (B) Root; (C) Fruiting-umbels; (D) Young plant; (E) Fruits. A to D about natural size; E magnified about 3 diameters.

[*Drawing by E. H. Atkinson*

size of hemlock fruits and the absence of the smell characteristic of aniseed are the chief points of difference. The plant most like hemlock in general appearance is fool's-parsley (*Aethusa Cynapium* L.), and it has the same mouse-like smell. As far as the writer is aware, however, this plant has not yet been recorded from New Zealand, but even if it should become naturalized here the fact that it further agrees with hemlock in possessing poisonous properties makes it unnecessary for the farmer to be able to distinguish between the two plants, both being undesirable.

THE POISONOUS PROPERTIES OF HEMLOCK.

It has been known from time immemorial that hemlock is an extremely poisonous plant, and it was employed by the ancients to poison criminals condemned to death, the case of Socrates being the classic instance of its use in this way. The "seeds" are the most dangerous part of the plant, which, however, is everywhere more or less poisonous, though drying decreases its virulence.

The effect of hemlock on man and animals is due to the presence of several alkaloids, the chief of which is coniin. This substance, which has the chemical formula $C_8H_{17}N$, is somewhat volatile at ordinary temperatures, has an alkaline reaction and a burning taste, and causes dilation of the pupil. The percentage of coniin in fresh leaves is 0·095 and in the ripe fruit 0·7.

The following account of the symptoms of hemlock poisoning is taken from Pammel ("Manual of Poisonous Plants," p. 651): "The symptoms in man are due to a general and gradual weakening of muscular power. The power of sight is often lost, but the mind usually remains clear until death ensues, as it soon does from the gradual paralysis of the lungs. . . . Many domestic animals have been killed by eating the plant, the prominent symptoms described for cows being the loss of appetite, salivation, bloating, much bodily pain, loss of muscular power, and rapid, feeble pulse. . . . It paralyses the ends of the motor nerves, then the trunks, and lastly the motor centre itself. Respiration is quickened and pupils contracted. The fatal dose, according to Blyth, is 2·3 grains."

HEMLOCK AS A WEED.

Hemlock has been naturalized for very many years in New Zealand, probably having originally spread from gardens, where it is occasionally grown. It is now abundant in a great many localities in both Islands, and it is not particular as to the class of soil it affects, though as a rule it occurs most abundantly in such places as stockyards and along roadsides, being particularly luxuriant where some shelter is afforded by hedges, &c., though this is not essential to it.

Hemlock is on the Third Schedule of the Noxious Weeds Act, and is "declared" by many local authorities. In the case of most plants that are regarded as weeds it is the fact of their occupying areas to the detriment or total exclusion of more useful plants that makes them objectionable. Looked at from this point of view alone hemlock, in comparison with many other plants, would sink to a position of insignificance in New Zealand, but owing to its poisonous properties, even if it is occupying ground that would not in any case

be carrying a useful crop, its presence in places accessible to stock is a menace to the farmer. Fortunately, however, the strong smell of the plant, which is so unpleasant to man, is equally so to most kinds of domestic animals, and the majority of cases of poisoning occur either with driven stock feeding on roadsides, &c., or during abnormal seasons when the supply of feed is small. A point of importance is that stock are far more likely to eat the plant after it has been cut and become partly dried than when it is in a growing and green condition. It is therefore recommended when cutting down any plants to at once remove them from the reach of stock.

As regards the actual control of hemlock very little can be said, except that it is advisable to be on the safe side and to grub out all plants that make their appearance. From what has been here said it will be obvious that it would be unwise to disregard the possibility of hemlock becoming highly dangerous under certain exceptional conditions, even where it has been known to exist for many years without causing any trouble.

HERD-TESTING ASSOCIATIONS.

SOME RESULTS FOR SEASON 1919–20.

W. M. SINGLETON, Assistant Director of the Dairy Division.

With the extension of C.O.R. testing and the appointment of additional testing officers for carrying on this work it has been found possible by the Dairy Division to undertake more association testing of ordinary dairy herds. During the past season some twenty-two dairy companies co-operated with the Division in carrying on this line of work. The season now coming will see a considerable extension of this method to some districts where hitherto little or no herd-testing has been undertaken, provided that testing requisites can be procured. Considerable organization work has already been done, and in a number of districts a start can be made shortly after the arrival of the milk-sample bottles which have been on order for many months.

Dairy companies' directorates co-operating in this work agree that the Dairy Division's testing officer shall have the use of each company's testing-room, testing-appliances, and steam free of cost. The herd-owner supplies his box for milk-samples, sample-bottles, spring balance, and sampling-dipper. Officers of the Dairy Division do the testing and figuring, and the record forms are supplied by the Department. For this service by the Department and officers of the Dairy Division a testing-fee of 2s. per cow per annum is charged. The collection of these fees is undertaken by the dairy companies, as the association members agree that their indebtedness shall be a charge on their milk accounts. It is an essential preliminary that the dairy company should agree to make this collection and pay the aggregate amount through the Dairy Division to the Public Account.

Only a portion of the total herd-testing of the Dominion is done by the Dairy Division. During the past season the spring was unfavourable to liberal production, but nevertheless many exceedingly creditable records have been made. We give below a tabulated list, in which the associations are indicated by numbers. No records of cows milking less than one hundred days have been included in the finding of the yield of the average association cow. The number of days which such average cow was in milk is given to enable a comparison to be made between yield and milking-period. The yield of the average cow in the best and poorest yielding herds of each association is also included. The statistics are as follows :—

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Fat.	Days.	Fat.	Days.	Fat.
			lb.		lb.		lb.
1 ..	390	218	210·65	227	317·13	119	66·53
2 ..	29	187	159·77	247	258·28	119	77·61
3 ..	259	198	217·95	242	301·63	118	144·92
4 ..	666	227	248·08	244	366·27	108	106·09
5 ..	834	216	228·43	255	317·63	128	117·94
6 ..	430	237	227·16	297	319·83	124	107·90
7 ..	304	262	289·62	299	403·47	259	234·22
8 ..	178	210	234·52	253	305·81	102	126·81
9 ..	682	213	251·23	244	349·36	100	101·20
10 ..	223	190	189·09	240	298·49	148	98·43
11 ..	499	225	206·97	249	288·69	178	114·63
12 ..	343	254	277·11	264	394·91	212	212·45
13 ..	265	188	195·31	265	347·01	105	85·59
14 ..	158	211	160·06	244	210·47	148	126·98
15 ..	265	187	177·58	221	296·04	150	108·42
16 ..	350	246	259·54	287	396·39	210	160·41
17 ..	437	210	195·53	265	362·76	124	85·84
18 ..	95	239	279·65	272	354·89	199	207·81
19 ..	630	204	220·82	255	304·37	127	98·48
20 ..	240	225	236·60	264	300·02	122	150·35
21 ..	195	214	202·08	251	263·38	113	102·59
22 ..	119	195	198·13	295	383·50	112	120·51

	Days.	Pounds Fat.
Average of all cows (7,591)	223	230·25
Highest association	262	289·62
Lowest association	187	159·77
Highest individual herd	299	403·47
Lowest individual herd	119	66·53
Highest individual cow	286	555·22
Lowest individual cow	101	11·98

The average cow in all these associations has a calculated yield of 230·25 lb. of butterfat, produced in a 223-day lactation period. This is very creditable, but it cannot be taken as a criterion of the production of the average cow of the Dominion. Each of these associations includes a comparatively small proportion of the cows supplying each of the dairy companies represented. As a rule the association members are above the average calibre of dairymen in the district, and thus the yield of the average association cow is undoubtedly in excess of that of the average cow supplying the same factory.

It will be noted that the association (No. 7) with the highest credit for butterfat per cow shows an average milking-period of 262 days, which is a longer period than that of the average cow of any other association represented in this list. The three associations, Nos. 7, 18, and 12, with average cows credited with 275 lb. of butterfat or more, show an average milking-period of 262, 239, and 254 days respectively. The majority of the associations with average cows yielding less than 200 lb. of fat have comparatively short milking-periods. The figures suggest that to obtain the better yields a fair length of milking-period is necessary. In association No. 7, which has the best average yield, it will be seen that the best producing herd of all the associations milked for an average period of 299 days, or ten months. This is accepted as an ideal length of milking-period. In this herd one cow is credited with 555·22 lb. fat in 286 days. This cow was in the best producing herd in its association—a herd which has a yield for the average cow of 396·39 lb. fat in 287 days. The owner is known to have been grading up his herd for some years by using registered purebred bulls, and saving heifers sired by these from the progeny of two good cows used as the principal foundation of the herd, so far as the female side is concerned. These high-producing herds are usually not accidents, but are rather the resultant product of years of planning, breeding, and patient effort.

The lowest average herd-yields of the last two columns, as contrasted with the figures of the highest-yielding herds in the respective associations, give a striking illustration of the necessity for a milking-period sufficiently long to enable a cow to do her best for her owner. It is manifest that cows must be so bred as to enable them to milk during a reasonably long lactation period, and that they receive the necessary feed to enable them to continue to the proper end.

THE LATE HON. W. D. S. MACDONALD.

It is with sincere regret that the *Journal* notices the untimely death, on 1st September, of the Hon. W. D. S. MacDonald, who held the portfolio of Agriculture during the term of the National Government, from 1915 to 1919. In his Ministerial leadership of the Department Mr. MacDonald proved himself a strong man and thoroughly progressive, although his policy was much handicapped by war restrictions. His wide practical experience as a farmer was also brought to bear effectively on many important matters. With his responsible officers he was a popular chief—concerning himself with the broader side of departmental administration rather than with its details—what is termed a good man to work with. His genial, sympathetic nature was well known. An excellent contemporary portrait of Mr. MacDonald was published as a frontispiece in the issue of the *Journal* for September, 1915, shortly after he became Minister of Agriculture. To Mr. MacDonald's family we extend deep sympathy in their loss, which is also the loss of the Dominion.

BREAKING-IN OF LIGHT PUMICE LANDS.

SETTLERS' EXPERIENCE.

W. G. BUTCHER and E. EARLE VAILE, Waiotapu.

LIGHT pumice soils occupy several million acres in the centre of the North Island. It is estimated that they constitute about one-twentieth of the whole cultivable and habitable lands of New Zealand, and the bringing of them to a profitable condition is undoubtedly one of the greatest development propositions before the Dominion to-day. The pumice country, it need hardly be remarked, includes considerable areas of superior river-flats and swamp-land, such, for instance, as large parts of the Reporoa Estate, recently acquired by the Government. But it is not such land as Reporoa that we are here concerned with; the following notes deal only with the light "poor" lands, concerning which there is still much uninformed prejudice. The vast bulk of such lands are ploughable—that is, easily ploughable—with a double-furrow plough. Areas that are not so ploughable are, in our judgment, best adapted for afforestation. It is marvellous country for growing trees, but for ordinary farming the land should be easily ploughable.

CLEARING AND PLOUGHING.

Light pumice country is probably the easiest broken in of any land. Clearing may be done in many places by fire put in about three years ahead of requirements. The horses and bars will break down the half-rotten sticks, and the plough will cut them up and bury them. Denser or heavier growth must be cut, and, as far as our experience goes, the common slash-hook is still the best means. We regard it as a mistake to bury anything but the lightest scrub. With heavier stuff a cushion is formed between the underlying earth and the furrow, which effectively prevents the soil-moisture rising. Consequently, a brief period of dry weather will kill anything sown in the top sod. Again, for about three years afterwards one cannot put the plough in, as all the buried sticks would be merely brought to the top. There are, however, large areas of tussock and light scrub that can be ploughed straight out of the rough.

Any plough will make a fair job in light pumice land, but probably the best for a first cultivation is a "heavy" P. and D. Duncan double-furrow. It will easily handle all ordinary stumps and pumicestones, saving many shillings per acre in clearing as compared with a lighter plough. It has sufficient clearance to avoid blocking with rubbish, and the weight on the skeith is enough to cut through ordinary sticks. The land should be ploughed as deep as possible, but so as not to turn up more than half an inch—or at the most an inch—of the raw sand or pumice. The depth can be slightly increased at each subsequent ploughing. The disking should follow the furrow, and one stroke is usually sufficient. Then harrow so as not to turn up roots, &c., to the

surface. Finally, roll heavily. Drilling should be done with a disk drill so as to avoid the gathering of rubbish in front of the hoes. It is not wise to work light pumice soils too fine.

THE FIRST CROP.

The first crop should be put in right away. This cannot be done too quickly. A bare fallow on really light pumice is the greatest mistake: the soil leaches badly, and sorrel soon takes possession. The crop undoubtedly should be turnips. Any pumice land will grow good turnips—the very lightest, soft turnips; the next better quality, Aberdeens; and the heavier and moister soils, swedes. Purple-top Mammoths, many roots weighing up to 14 lb. each, have been grown on pure pumice sand, on a first furrow, with 2 cwt. manure to the acre. Of course, these turnips need feeding off when they are just right. Aberdeens—we prefer the Green-top variety—do well on soils only slightly heavier, and can be fed right into September. The best time to sow turnips is in the latter half of December. If any one doubts the capacity of pumice lands to grow turnips let him study the regularity with which roots from the Rotorua–Waiotapu country secure prizes at the Waikato, Palmerston North, and other leading winter shows—and this without special attention or cultivation having been given for show purposes.

In sowing turnips we give 1 cwt. each of super and blood-and-bone —2 cwt. in all. It would really pay to give 3 cwt. if one's resources allowed. Usually we have rolled again after the drill, but this may not be necessary or, in some cases, advisable. A light brush harrow towed behind tends to cover all seed on the naturally somewhat rough surface of a first cultivation. A stroke of the chain harrows in front of the drill, if there is time and if the soil is not already too fine, tends greatly to an even surface.

SUBSEQUENT CROPS.

We do not advise grain crops in light pumice land, as they take too much out of it and encourage sorrel. In almost any section in this district an area of heavier land may be found upon which to grow oats. But if one must grow chaff on the light land a heavy crop should not be aimed at. Between 1½ and 2 bushels of seed, with 2 cwt. of the same mixture of manure, should give a good enough cut. Duns in autumn, Sparrowbills in early spring, and Tartars in later spring have given best results. Rust is very rare in the pumice country.

GRASSING.

The main consideration in grassing is getting a soil-covering. Bare spaces are fatal; therefore grasses that will grow should be sown. Cocksfoot gives most feed, except in winter, when frosts cut it rather badly. Perennial rye-grass is not perennial—if one may express it that way. Italian rye is useful for a quick bite while the other grasses come on. Crested dogstail forms a good sward. Danthonia —the pilosa variety—forms a dense sole absolutely permanent, and keeps green throughout the winter. It is hard to sow through a distributor. Brown-top gives good pasture in spring and autumn, but yields no feed during frosts or drought. It, more than any other

grass, tends to creep into and fill up all bare spaces, although inclined to get root-bound. Yorkshire fog is a grass too much neglected. It grows anywhere and gives a great bulk of feed, even if it be of rather poor quality. More than any other grass it adds humus to the soil, and it gives place to better grasses without much trouble. Among the clovers cow-grass is supreme, yielding an immense quantity of rich feed on all pumice soils. On its cost it pays far better than any other pasture plant. White clover also thrives astonishingly, and, once established, never leaves the soil. The native trefoil or suckling-clover is very useful, and sheep's burnet is a welcome addition to the bulk of the pasture.

The following is a good mixture for ordinary light pumice land: Cocksfoot, 10 lb.; Italian rye-grass, 4 lb.; crested dogstail, 4 lb.; Yorkshire fog, 2 lb.; brown-top, ½ lb.; Chewings fescue, ½ lb.; cow-grass, 4 lb.; white clover, 1 lb.; suckling-clover, 1 lb.; sheep's burnet, 2 lb.; with 6 oz. soft turnips added for spring sowing, or 1 bushel ryecorn for autumn sowing. If this should be considered too expensive a seeding the cocksfoot might be cut down 2 lb. and the rye-grass and dogstail 1 lb. each.

A mixture such as this, for a first furrow, will become quite permanent, but probably it will pay to plough it after about seven or eight years. A crop of swedes should be put in this time, and the land afterwards relaid with better grasses for a permanent sward.

In our opinion manure is best applied with the seed—as much as can be afforded within reason, but not less than 2 cwt. per acre. Superphosphate mixed with blood-and-bone or bonedust gives best results. Basic slag and Egyptian phosphate do not seem suitable for light pumice land. Spring sowing should take place early in October, and autumn sowing in the latter half of February or the first week in March.

For surface-sowing we recommend Danthonia pilosa, 3 lb.; brown-top, 1 lb.; Yorkshire fog, 5 lb.; suckling-clover, 1 lb.; white clover, ½ lb.; sweet vernal, ¼ lb.; Lotus hispidus, 1 lb.; Chewings fescue, 2 lb.; and crested dogstail, 1 lb.

Some settlers adopt and strongly advocate the practice of sowing grass and turnips together on the first furrow, and this plan certainly yields a quick pasture. On no account should oats for a crop be sown with the grass.

MANAGEMENT OF PASTURE.

There is as much in the treatment of the paddock after being laid down as there is in the laying-down itself. Overstocking should be carefully avoided, especially in the autumn or early winter. If at that time the roots are left exposed to all the frosts of winter, deterioration is bound to ensue—especially of cocksfoot. Do not put stock on to young grass too soon. It is best to stock first with calves. Keep sheep; and even more particularly horses, off for the first year, if possible. After a year or two it is an excellent plan to "fog" a paddock—that is, to shut it up in September or October and rigorously keep stock off it till early March. By this means much seed is cast, and a mass of vegetation goes down on the surface, forming a mulch of humus. This greatly encourages the stronger pasture-plants—cocksfoot and cow-grass especially—and is a cheap method of restoration. If the paddock is then heavily stocked in March the seed is trodden in, and much will germinate.

The writers have not tried top-dressing, but doubtless it would be beneficial. Nor have they had enough heart to plough in green crops. In their opinion it is preferable to feed off these green crops, and the resultant dung, with a little artificial manure added, will probably pay better than ploughing in the crop itself. Again, a surface covering as compact as possible should be created and maintained. Do not plough and leave light pumice soil bare if it can be avoided.

GENERAL.

Pumice soil is very kindly stuff to work. Never sodden, never baked—it may be worked at will every day in the year. It handles soft and velvety, is very warm, and forms a perfect seed-bed. Pumice may fairly be termed natural grass country. Even if one has had a bad strike, under careful management the grass will thicken out. The soil yields wonderfully to judicious cultivation and manuring. Cows are found to milk extremely well on pumice land. It must be borne in mind that large parts of the Waikato district are pumiceous soils.

The pumice country proper, however, is no place for the lazy man. Growth in the winter is meagre, and provision of fodder must be made for the time of scarcity. Here nature comes to the rescue, for there is no land that will grow clover for hay or roots for feeding off in the winter better than the pumice lands. And they are exceptionally suited, too, for the feeding-off process—never any slop or mud, while the soil is much improved by the tramping of the stock.

At the request of the Editor we have noted down as above the results of many years' practical experience in the working of light pumice land. There is, of course, plenty of room for further experiment, and other persons may arrive at somewhat different conclusions. We trust that others will be given the opportunity to follow up the subject in the pages of the *Journal*.

"Tarry" Soils. — In his annual report for 1919–20 the Department's Chemist (Mr. B. C. Aston) mentions that the so-called tarry soils of Oamaru have been investigated, and found to have a lime-requirement of from $\frac{1}{2}$ to $\frac{3}{4}$ ton of carbonate of lime per acre. These soils rest on a limestone subsoil, and are another instance of the popular fallacy which assumes that because a soil is on limestone it contains sufficient lime.

North Canterbury Scrub Lands. — Further samples of these soils recently examined by the Chemistry Section proved, after separation from the gravel, to be fine sandy silts or loams deficient in available and total phosphoric acid, the amounts of nitrogen and other mineral plant-foods being high. The Chemist states that the treatment indicated as most desirable would seem from analysis to be phosphatic and lime-carbonate manuring, and the stimulation of the growth of Leguminosæ with a view to increasing the humus in these light lands. The area in question is situated between the Rivers Eyre and Waimakiriri, some thirty miles to the north of Christchurch.

THE PIGGERY.

K. W. GORRINGE, Instructor in Swine Husbandry.

SITE.

It is not generally recognized by farmers how important it is that great care should be taken in the selection of a site for the piggery. Many mistakes have been made in the past in this respect, resulting in severe losses both to breeders and feeders. Farmers, in fact, have followed the ideas practised by their forefathers, and have too often built their piggeries more for the sake of their own convenience than for the comfort and well-being of the pigs. They have not sufficiently realized what they are doing when they enclose any small plot of ground—say, about half a chain square—and place a shed in one corner in which to keep their pigs from year to year. This may give good results for a start, but as time goes on the shed and the whole plot become infested with parasites and germs, unless special attention is given to the disinfecting of the whole premises, which, one regrets to say, is very generally neglected. One often hears the remark that a place is "pig-sick." The proper definition of the matter is that the piggery is so infested for want of proper sanitation that the pigs have to fight for their very existence.

In selecting a site it is important to avoid low or wet ground. High ground with good drainage, a gentle slope, or rolling country, is to be preferred. If it is the breeder's special desire to build a permanent or central house, special care should be taken to choose the most suitable site for the house to rest on. Springs under the ground, not seen or felt, yet close to the surface, have been the cause of continual dampness throughout pig-houses, even though the whole of the ground-surface has been covered with brick or concrete.

It is advisable to portion off an area of the farm for the pigs, the minimum to be 1½ acres, divided up into four equal paddocks—the idea being to give the animals a change from one paddock to another. These paddocks can be sown down with any good forage crops and grasses, and the fact that they will occasionally be ploughed up and resown will tend to keep the area in a good, healthy, and sanitary condition.

In connection with a site the water-supply is of the greatest importance. Provision must usually be made to supply this artificially, as it cannot be obtained by having a creek running through the piggery in cases where the water flows through another property afterwards. Good fresh water plays a very important part in the health of all pigs, whereas foul and dirty water is often the cause of worms and other intestinal complaints. It is essential that good clean water be within reach of the pigs at all times; it is astonishing what a large quantity will be consumed, especially during the summer months.

Together with the question of site, the legal provisions embodied in different statutes must always be kept in view. No drainage from a piggery is allowed into a running stream if this afterwards runs through another property, or is afterwards used for any other purpose. All pigs must be kept at least 50 yards away from the nearest milking-shed, dairy, or slaughterhouse, and must not be so placed as to become a nuisance to the general public or adjoining dwellings in occupation.

SHELTER.

Shelter from exposure is a very important point. The prevailing wind should be taken into consideration, and the piggery so placed as to have as much protection as possible from cold biting winds. If this is difficult, provision should be made for rapid-growing shrubs, &c., just outside the fence. Trees or other taller growths should be kept some yards away, as in after-years they will have the tendency to keep the piggery damp if they are planted too close. On many farms a belt or block of natural bush has been kept for general shelter. This could be used to great advantage in connection with the site of the piggery. It will also be found beneficial to have a few shelter-trees planted down the subdivisions, such as willows, wattles, or any variety that has a good top and a small root-system. A large-rooted tree would in time interfere with the ploughing operation in the paddocks.

FENCING AND YARDS.

With regard to the style of fencing, this must be left to the judgment of the breeder. It has been found that a fence containing six pig-barbed wires, one plain wire, and one ordinary barb wire on top to make it cattle-proof, gives good results for the outside boundaries. Six posts to the chain, with four battens in between, will be sufficient. For the subdivision fences seven plain wires, well strained, with six battens between posts (spaced six to the chain) will be found to give satisfaction. If the plain wires can be strained on the roller system, the roller to remain on the strainer-post, in the event of any wire becoming slackened it is very easy to tighten again. Suitable distances apart for the wires on the boundary-fence are one nearly on the ground, then two at 3 in., two at 4 in., one at 6 in., one at 9 in., and one at 14 in. For the subdivisions the distances will be one wire close to the ground, three at 3 in., and three at 4 in. If the breeder can afford to be liberal with extra battens, so much the better for the life of the fence. Provision should be made for gates 9 ft. wide into each paddock, so as to allow any farm implement, also the pig-houses, to pass through.

It will be found very handy to provide a small yard as a drafting-pen, in which can be built the staging for loading and unloading pigs to and from market. There should also be an enclosure some distance apart for the purpose of isolating pigs suspected of disease, or to accommodate any pigs which may be introduced until such time as it is evident that they are free from infectious or contagious disease. This enclosure should be so constructed as to be easily disinfected if it be necessary to do so.

HOUSING.

Pigs are very susceptible to the unfavourable influences of damp, cold, heat, and draughts. The pig-house should thus be warm, so that a minimum amount of feed will be used up in maintaining the body-heat of the animals. It should also be dry; sweating walls or damp floors are highly objectionable. There should be an abundance of sunshine in the cold months, as sunshine is not only one of the greatest germ-killers known, but tends to dryness and warmth, besides having an invigorating effect on the pigs. Plenty of fresh air without draughts is also a feature of importance.

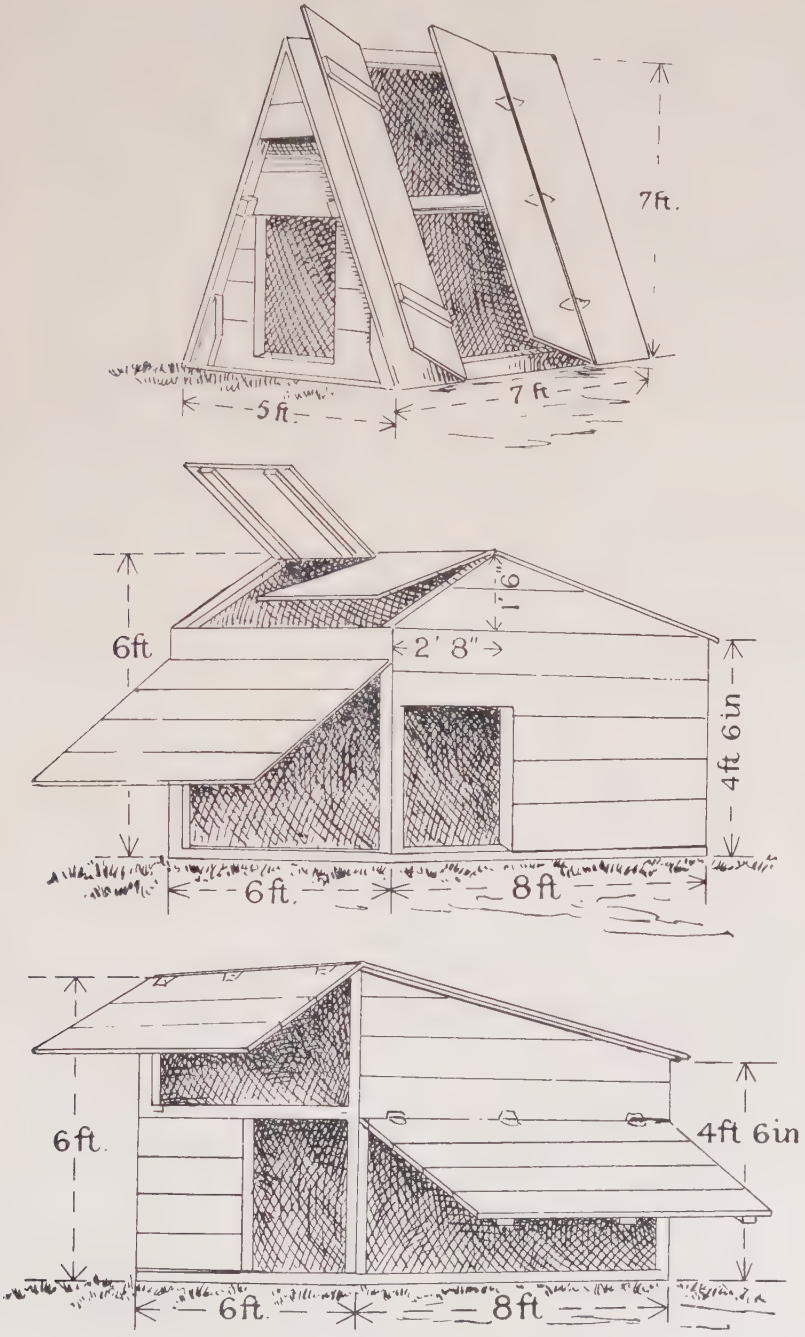
There are two general types of pig-houses — the central type, and the individual or movable house. A central house contains a number of farrowing and fattening pens under the same roof, while an individual house is made so as to keep only a single farrowing-sow, or it can be used for a number of young growing pigs. The chief advantages claimed for central houses are that they are more convenient, necessitate less labour and care for the pigs, and are warmer. On the other hand, it is claimed for individual houses that they are cheap and easy to build, better for farrowing-sows (preventing crowding or piling up), quieter, movable to cleaner ground, and more sanitary.

Owing to the favourable climatic conditions for pig-keeping in New Zealand as compared with many other countries, I am of opinion that the central house has very little advantage here. It is, besides, very expensive to construct and beyond the means of the average breeder. I have found that where a large number of animals are housed under one roof the atmosphere becomes very dead, and young pigs farrowed under such conditions do not thrive nearly so well as those farrowed in individual houses. After comparing the useful points of both types I therefore do not advocate the building of central houses for general use of the average farmer.

If, however, the breeder specially desires a central house great care must be taken, as previously mentioned, in the selection of the site on which it is to rest. Allowance must be made for good drainage, also for the admission of sunlight throughout the whole house. It is generally the breeder with a large herd who adopts this mode of housing, and one of the many designs can be selected and built to requirements. It should be realized, however, that if the breeder is not prepared to keep such a house very clean and to be liberal in the use of disinfectants trouble may be expected. In building a central house a concrete reservoir should be placed at the end of the building to catch all the drainage. No breeder should be guilty of wasting this valuable liquid manure, which can be pumped up and carted over the land at comparatively little expense.

INDIVIDUAL MOVABLE HOUSES.

From my experience and observation generally, and taking into consideration the economy in construction, ease of handling, and greater healthfulness, I consider, without a doubt, that the light movable pig-house provides the best and cheapest housing for general use. There are various designs to choose from—the gable-shaped, the two-thirds span roof, the lean-to, &c., as shown in the accompany-



DIAGRAMS OF MOVABLE PIG-HOUSES.

(Runners not shown.)

ing diagrams, which also give the principal measurements. The diagrams indicate wood boarding, but other materials, such as iron, or rubberized felting, may be used, as convenient. Each house rests on 4 in. by 4 in. runners; these are not shown in the diagrams. Around the inside of the houses, 8 in. from the sides and floor, a guard-rail must be placed for the protection of the young pigs. Ventilation is provided at the ends of the roof, and parts of the sides or roofs are hinged for opening out to let in the sun, as shown. Whereas permanent houses should be built facing the north, so as to get as much sun as possible, portable houses can be moved to suit the convenience of the breeder and the comfort of the pigs.

CLEANING AND DISINFECTING.

Any style of house can become infested with parasites and germs; therefore the houses must be kept clean, no dirt being allowed to accumulate in the corners. It is of little use applying a disinfectant on top of a coating of filth which may conceal and protect millions of disease-germs. A good spray-pump is the best to use, so as to force the liquid into every crack, and every part of the pen should be thoroughly saturated with the solution. Limewash is also good. A liberal sprinkling of slaked lime will be found beneficial around houses, feeding-troughs, and yards.

Proper attention to this important question of housing will mean the saving to the country of thousands of young pigs, besides greatly increasing profits by making feeding more effective.

SEED-TESTING AND CONTROL IN UNITED STATES.

Mr. A. H. Cockayne, Biologist to the Department, makes the following remarks on this subject in his annual report for 1919–20:—

"While in the United States last year I paid considerable attention to seed-testing methods in vogue there, and also studied the effect of many of the seed laws that are in operation. With regard to seed-testing, great care is taken that lines reported on are extremely carefully sampled. This is a matter requiring considerable attention on the part of merchants here. Many if not all the discrepancies arising in the germination of such seeds as cocksfoot, Chewings fescue, and the like are due to the sending into the laboratory of samples carelessly sampled and not truly representative of the line in question. I found this same defect had been quite common in the seed-testing work of many of the States, but seed-merchants there now recognize that the laboratory test is true only of the samples submitted, and if not sampled properly may give quite an erroneous result so far as the whole line is concerned.

"Very special emphasis is given in the United States on the control of imported seed, and unless lines come within the standards of real value—*i.e.*, certain definite percentages of purity and germination—such seed is not allowed to be sold. Some similar method of control of imported seed should operate in New Zealand, and this phase of the question has been embodied in a Seeds Bill which has now been prepared."

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, 1919–20.

J. W. DEEM, Fields Instructor, Wanganui.

THE weather during the 1919-20 season was very unsatisfactory for working the Marton Experimental Area, rain falling with great regularity, which greatly delayed all farm operations, harvest-work being especially trying.

The crops grown consisted of 9 acres Algerian oats, 1 acre Ruakura oats, 9 acres wheat (six varieties), 8½ acres skinless barley (two varieties), 11 acres peas (five varieties), 1 acre millet (seven varieties), ½ acre Sudan grass, 2 acres swedes (thirty varieties), 2 acres turnips (fifteen varieties), 1½ acres rape, 1 acre kale (six varieties), and 1 acre potatoes. In addition to these another acre of lucerne was established, half Marlborough and half Grimm varieties.

The wheat was sown on 5th and 6th September, and harvested between 29th January and 11th February. As was the case last year, Major gave the heaviest yield—namely, 56 bushels per acre; Purple-straw Tuscan was second with 44 bushels, and John Brown lowest with 29 bushels. The latter variety was the first ripe and suffered to some extent by birds, it being estimated that they took between five and six bushels per acre.

The barleys—Black and Brown Skinless—were grown on a wet paddock that could not be worked early. Sowing was done on 31st October, and the crop was ready to cut at the end of January, these barleys thus maintaining their reputation for rapid maturity. The Black variety threshed 48 bushels and the Brown 36 bushels per acre.

The peas were grown to build up the fertility and help to clean a field, recently taken over by the Department, which was badly infested with couch (*Agrostis stolonifera*). Most of the peas made very heavy growth, but bad weather prevented them being harvested in good condition. The varieties grown were Blue Imperial, Partridge, Stratagem, Arthur, and Canadian Field. All except Stratagem did good work in smothering couch, but the best were Canadian Field and Partridge, the former showing to special advantage. It is intended to try the effects of the Canadian Field variety on another very couchy paddock this year. In another field badly infested with spurrey (*Spergula arvensis*) and red-shank (*Polygonum Persicaria*) peas *versus* rape were tested for smothering, sown at the end of November. The peas came away fast and completely controlled the weeds, while the rape was badly infested.

A feeding experiment, peas *versus* rape, was also carried out on this area. There were 2 acres of peas and 1 of rape. A line of 150 lambs was divided, 50 put on the rape and 100 on the peas. The weather during the first two weeks of the experiment was very wet, and as no run-off could be provided the peas were tramped down flat and the lambs did badly, and it was thought the experiment would have to be abandoned. However, at the end of a fortnight

the weather took up and the test was continued. At the end of twenty-five days the rape was finished, and the lambs off both the rape and the peas were weighed. The rape lambs showed a gain of 6·2 lb. per head, while the pea lambs showed a loss of 0·46 lb. As there were still a good many peas on the ground, and the lambs appeared to be doing better, it was decided to put them back on the peas for another week, when they were again weighed and showed a gain of 2·58 lb. per head. In each case the lambs were penned up fifteen hours before being weighed. Three points strongly brought out were that lambs feeding off peas should be provided with a run-off for the first week or two, that they should have plenty of clean drinking-water, and that they should not be turned on to the peas until the bulk of the peas are firm and getting ripe. In the present case they appeared to do best after the ripe peas had fallen to the ground. It is intended to repeat this experiment during the season now commencing.

The millets gave heavy cutting, Japanese and Hungarian being the best. The former was ready to cut a fortnight before the latter. Sudan grass was ready before any of the millets, and gave the most forage with a good second growth. Stock also preferred it to the millets, although all were relished.

In the potato test New Era proved the best, standing up and producing a good crop, while the others were blighted.

The swedes were tested for disease-resistance. There was no club-root, but many of the varieties showed nodular growths. All varieties were attacked by dry-rot, ranging from 17 to 73 per cent. of affected roots at time of recording. A piece of very weedy land was selected, and a test carried out in swede-growing practice—ridging 28 in. drills *versus* sowing on the flat in 14 in. drills with ordinary drill. The ridged area was horse-hoed twice and the weeds fairly well controlled. The ridged crops weighed 29 tons 19 cwt. per acre, against 9 tons 14 cwt. on the 14-in.-drills area. The swedes on the former area were well developed and grew well out of the ground, and were in good condition for feeding off in wet weather, while those in the 14 in. drills, which had no after-cultivation, were smothered in weeds (that seeded), were small and of poor quality, deep in the ground, and hard to feed off by sheep. A strong point in favour of the ridging on heavy land like that about Marton is that when the land is wet the ridged swedes stand up dry and clean, while those on the flat are fouled, and sheep get in a very dirty state feeding on them, especially in wet weather.

In the turnip varieties, Lincolnshire Red Globe, Hardy Green Globe, and Vilmorin's Purple-top White Globe gave the best results.

Five acres of temporary pasture—Italian rye-grass and red clover—was closed on 1st October and cut for hay, being saved under fair conditions. The green and pressed weights are of interest. The first cutting, on 19th December, was mostly rye-grass. Several definite areas were weighed, and the crops averaged 7 tons 14 cwt. per acre, or a total for the 5 acres of 37 tons 14 cwt., which, when pressed three months later, turned out 9⅔ tons of hay. The field was cut again on 16th February, when the cut was practically all red clover, green weight 7 tons 15 cwt. per acre, total 37 tons 15 cwt., which pressed out 8 tons of hay, giving for the two cuts an average

return of approximately 3 tons 10½ cwt. of hay per acre for the period 1st October to 16th February. It should be mentioned that this field carried 135 sheep all through September, and was ready for grazing again at the end of February.

A feeding experiment to test palatability was also carried out with 1 acre of fodder crops consisting of rape, Green-top Aberdeen turnips, chou moellier (marrow-stem kale, green varieties), chou moellier (marrow-stem kale, red varieties), and Thousand-headed kale. The acre carried fifty lambs for a month, and they preferred the fodders in the order named, practically eating them in this rotation. The lambs showed an average gain of 7·32 lb. per head for the thirty days.

CALF-REARING TESTS AT EXPERIMENTAL FARMS.

THE many dairy-farmers and others who perused the account of the calf-rearing experiments conducted at the Department's experimental farms, published in the *Journal* for May last, will be interested to learn that the whole of the four groups of calves reared at Weraroa were wintered on the farm with the object of observing the constitutional after-effect of the different foods on these animals during that period.

The Farm Manager, Mr. W. J. McCulloch, reports that all the calves came through very successfully. The animals were weighed on 16th August, with the following results :—

Group 1 (flour and linseed-meal) : Total weight, 1,610 lb. ; average gain of each calf (four) since close of test, 157¾ lb.

Group 2 (crushed oats) : Total weight, 1,687 lb. ; average gain of each calf, 146¼ lb.

Group 3 (linseed gruel) : Total weight, 1,701 lb. ; average gain of each calf, 167¼ lb.

Group 4 (bean-meal and linseed-meal) : Total weight, 1,932 lb. ; average gain of each calf, 144¼ lb.

(Artificial foods only are indicated above. For details of dietary see May *Journal*.)

The animals were not nursed in any way during the period since weaning in March last ; indeed, until the last three or four weeks before weighing they had neither hay nor roots. The stock were subsequently sold in the local yards, and it was widely remarked that they were the healthiest, best-grown, and best-conditioned animals for their age offered at the sale.

In regard to the Ruakura trials, some of the calves were disposed of after the close of the tests. The remainder, however, are still on the farm, and have done just as well as the Weraroa animals.

It may be mentioned that another series of calf-feeding experiments has been commenced this season at Ruakura, Weraroa, and Moumahaki, with sundry variations suggested by last season's experience.

LEAF-STEM GALL-APHIS OF THE POPLAR.

DAVID MILLER, Entomologist.

LAST March specimens of galls infesting the leaf-petioles of poplar-trees in Central Otago were collected by Mr. J. Law, of Ranfurly, and forwarded for identification. On examination it was found that these galls were the work of the poplar-gall-aphis (*Pemphigus populi-transversus* Riley), a species frequently found upon poplar-trees in North America. This insect is of some interest to agriculturists, since it not merely infests poplar-trees but has also been recorded from the roots of cruciferous plants.

FIG. 1. GALLS OF PEMPHIGUS POPULI-TRANSVERSUS UPON LEAF-STEMS OF POPLAR.
Magnified about twice. [*Photo, E. Bruce Levy.*

The full-grown gall upon the poplar (Fig. 1) measures anything from $\frac{1}{2}$ in. to 1 in. in length, and resembles a sack in outline, though some

are more or less globular; the walls are thick and tough with the outer surface wrinkled, while at the end toward one side is a slit-like or sometimes circular opening surrounded by a thickened lip-like rim. Within the gall is a mass of white flocculent secretion exuded by large numbers of aphides, which are wingless females only and give birth to living young.

During the summer, and particularly toward the end of autumn, winged females appear among the wingless forms and escape through the opening of the gall. The body and legs of these females are black, the abdomen yellowish, and the wings grey and slightly clouded, with a blackish area along the front edge (Fig. 2). On leaving the gall they migrate to the leaves of cruciferous plants, such as rape, cabbage, mustard, and turnips, and several weeds allied to these cultivated forms, where they give birth to living wingless females. These in turn move from the leaves on to the roots of the food plants, and establish thereon a colony of yellowish wingless forms. The subterranean colonies can be readily located on account of patches of woolly secretion which the insects exude upon the roots of infested plants. Although these insects live on the roots of cruciferous crops as well as weeds, normally they cause no appreciable damage, but the loss would be considerable if the infestation became at all severe.

FIG. 2. WINGED FEMALE OF PEMPHIGUS POPULI-TRANSVERSUS.

Small figure on bottom left is natural size.

[*Drawing by D. Miller.*

Winged females, similar to those developing from the poplar-galls in the autumn, issue from the root colonies in the spring and return to the poplar-trees, where they give birth to living males and females, both of which are wingless. This is the only stage in the life-cycle of the insect when males appear. The female in this case is very small, with a light-yellow body and paler legs, while the male is smaller still and of a delicate green colour. In due course the females deposit their minute yellowish-white eggs in some crevice upon the bark, and the young wingless yellowish-green forms hatching therefrom move on to the leaf-petioles, where they form the galls from which the winged females emerge in the autumn and migrate back to cruciferous plants.

When the aphis settles to form its gall the leaf-petiole commences to thicken, and curves to one side at this point. The thickening continues to swell until the fully mature gall is formed in late summer and through the autumn.

Pasteurization in Cheesemaking. — The annual report of the Dairy Division for 1919–20 states that the demand for regenerative pasteurizing-machines—which is invariably the type used—has been greater than the supply. As additional plants are imported or manufactured locally they are eagerly purchased by dairy companies which have decided to adopt this system of treating the milk for the manufacture of cheese. The number of factories at which these machines had already been provided was 155, and the total quantity of cheese manufactured from pasteurized milk amounted to 32,200 tons, equivalent to 53 per cent. of the year's production.

POULTRY-FEEDING: MEAT *versus* NO MEAT.

F. C. BROWN, Chief Poultry Instructor.

A FEEDING-TEST has been carried out at the Department's Milton Poultry station for the purpose of ascertaining as far as possible the effect of meat-meal on egg-yield. Twenty-four White Leghorn pullets of even type and of the same age were selected for the test and divided into four pens of six each. The ingredients of the ration provided to each pen were similar in every respect excepting that meat-meal was included in the case of two of the pens (3 and 4). The test extended over a period of fifty-two weeks, commencing on 8th April, 1919. The results in egg-yield and in cost of food consumed by each bird are given in the following tables:—

Pens 1 and 2 (no Meat).

	£ s. d.	£ s. d.
Ground wheat, 332 lb., at 6s. 8d. per bushel	1 10 10	
Cost of grinding	0 2 6	
		1 10 4
Pollard, 108 lb., at £9 5s. per ton		0 10 0
Bran, 218 lb., at £7 5s. per ton		0 15 10
Whole wheat, 652 lb., at 6s. 8d. per bushel		3 12 6
Cost of feed for twelve birds		6 17 8
Cost of feed for one bird		0 11 6

Pens 3 and 4 (Meat-fed).

	£ s. d.	£ s. d.
Ground wheat, 342 lb., at 6s. 8d. per bushel	1 18 6	
Cost of grinding	0 2 8	
		2 0 8
Pollard, 108 lb., at £9 5s. per ton		0 10 0
Bran, 225 lb., at £7 5s. per ton		0 10 4
Meat-meal in mash, 45 lb., at £1 per 100 lb.		0 9 0
Meat-meal kept in front of birds, 51½ lb., at £1 per 100 lb.		0 10 4
Whole wheat, 668 lb., at 6s. 8d. per bushel		3 14 2
Cost of feed for twelve birds		8 0 0
Cost of feed for one bird		0 13 4½

Pen.	Number of Eggs produced.	Cost of Food per Bird (Wholesale Rates).	Average Number of Eggs per Bird.	Amount received per cent. for Eggs at 2s. 2d. per Dozen.	Number of Cost of Food per Bird.
		£ s. d.		£ s. d.	£ s. d.
1 ..	1,257	0 11 0	209½	1 17 10	1 6 4
2 ..	1,294	0 11 0	215⅔	1 10 0	1 7 6
3 ..	1,482	0 13 4½	247	2 4 7	1 11 2½
4 ..	1,005	0 13 4½	207½	2 8 4	1 14 11½

Examining the results, it is worthy of note that while pens 3 and 4 produced the most eggs, they also cost the most to feed. It would appear that the inclusion of meat-meal in the mash makes it more appetising, and results in increased consumption. A total of 96½ lb. of meat-meal was consumed by the twelve birds, 45 lb. of which was included in the morning mash and 51½ lb. eaten from hoppers, where it was always available for the birds to pick at. The meat-fed birds cost 1s. 10d. a bird more to feed than the non-meat pens, but against this they produced an average of forty-five more eggs each. At the average market price available this shows an extra return for the meat-fed birds of 8s. 1d. each, or an extra profit of 6s. 2d. each, which indicates that the addition of animal food to the ration not only increases the egg-yield but the net profit as well. The cost of food for each bird is based on the wholesale ruling rates when the materials were bought. No charge has been made for cartage, or for green food and grit supplied.

The test is being continued for another year, but the rations have been reversed, pens 1 and 2 now receiving meat-meal, while pens 3 and 4 have none.

FIRE-BLIGHT.

NOTES FOR FRUITGROWERS.

G. H. CUNNINGHAM, Biology Section.

THE fruit-tree disease known as "fire-blight," which made its appearance in several districts of the Auckland Province last season, is a bacterial affection caused by *Bacillus amylovorus*. Bacteria are minute plants, which, lacking the green colouring-matter (chlorophyll) of higher plants, have of necessity to live on the elaborated food already prepared by higher plants or animals, as they are unable to elaborate these complex foods necessary for their growth. They may live on dead organic matter, or may attack living plants or animals, and so cause diseases of various kinds.

Bacillus amylovorus gains entry to the host plant in various ways, which are dealt with more fully later on. Once in the tissues it migrates to the intercellular spaces some distance above and below the point of entry. As bacteria increase very rapidly (it has been estimated that under favourable conditions the progeny of a single bacterium would amount to 16,500,000 in twenty-four hours) the diseased areas soon increase in size. In point of fact, the organisms are usually in the tissues in advance of the visible diseased areas. In the tissues the organism plasmolyses individual cells by extracting the moisture from the cell-sap, &c., the protoplasm of the cell soon drying in consequence. So far as is known the organism does not secrete a toxin.

Bacteria can only multiply and perform their various life functions under the influence of an equable temperature, the optimum for *B. amylovorus* being 25° – 30° C. If the temperature rises consider-

ably above this (40° – 43° C.) bacteria are quickly killed. When cooler weather sets in (late autumn) those organisms of *B. amylovorus* remaining in the plant-tissues become quiescent and remain inactive until the return of warm weather in the succeeding spring. No spores are found, however.

THE OOZE PERIOD.

On the approach of spring the bacilli in the larger cankered areas (they do not, as a rule, remain visible in the smaller shoots) become active and begin to multiply with rapidity. They increase in numbers so rapidly and plasmolyse the cell-contents to such an extent that large masses of a sticky substance (which consists of cell-sap and bacilli) are forced through the epidermis to the surface. This is the ooze period, and is the most serious to the orchardist, as it is from these exuded masses that the disease is spread each spring.

Insects readily devour this ooze, and carry away attached to their legs, probosces, &c., enormous numbers of the organisms. If the insect chances to visit the flower of a pear, apple, quince, &c., the organisms are released in the calyx-cup and readily make their way into the tissues of the nectary.

FLOWER-INFECTION.

With us the flower-infection stage has been the most serious of all, as the grower loses not only the present crop, but has a badly infected tree on his hands to deal with. Flower-infection is spread by insects, which visit first the ooze of cankers, then the flowers, spreading the bacteria from flower to flower until all the blossoms on the tree may be infected. These blossoms quickly turn brown, wither, and die, but remain attached to the spurs on which they are borne. They become very noticeable as grey dead patches among the young green foliage of the tree. The organisms migrate down the stalk of the blossom into the spurs, and from there into the tissues of the bark. Here they quickly spread out in a circular manner, gradually forming cankered areas, which increase until the whole branch may be ring-barked.

If a branch is ring-barked it wilts suddenly, the leaves change colour and shrivel, finally turning dark brown, but they remain persistent. Sometimes the whole of the top growth of the tree may appear as if scorched. This is largely due to the fact that most of the smaller limbs have been ring-barked. It is from this scorched appearance of the trees that the disease has obtained its name.

CANKER FORMATION AND TREATMENT.

Later in the season green aphis makes its appearance, and spreads the disease on to the young growing shoots. They quickly turn brown and curl up at the top in a most characteristic manner. These shoots die back for a distance of 5 in. or 6 in., forming a definite canker at the junction with the new wood. It is advisable to cut out all such shoots as soon as they make their appearance.

It is obvious that the source of the disease each season is these cankers, which as soon as they begin to ooze are visited by insects, which in turn carry the disease to young flowers. Remedial measures, therefore, lie in the cutting-out of cankered areas. Where small,

the whole affected branch is better cut out. If the canker is low down on a main limb, and the grower wishes to save the limb, he may rid the tree by cutting away the bark down to wood for a distance of 3 in. above and below the outside visible edge of the canker. The wood should then be painted over with formalin solution, 1–20 (1 part formalin to 20 parts water). Knives, &c., used in cutting should be sterilized after each cut by wiping the blade with a swab of cotton-wool dipped in the 1–20 solution. The wound should then receive a dressing of creosote and tar mixed to the consistency of ordinary paint.

NOTE.—Remarks on the fire-blight campaign will be found at the head of the "Orchard" monthly notes in this issue.

ENSILAGE-MAKING AT STRATFORD MODEL DAIRY FARM.

A. J. GLASSON, Fields Instructor, Hawera.

THE variable weather conditions of central Taranaki are, as a rule, not suitable for haymaking, and the difficulties experienced in previous years were mainly responsible for the management of the Stratford Model Dairy Farm deciding to make ensilage during last season.

The previous season's turnip and mangold ground, 8½ acres, was prepared and sown on 20th October in ensilage crops, as follows: 1½ acres, Bobs wheat 2 bushels, and tares 1 bushel, per acre; 2 acres, Algerian oats 2 bushels, and Partridge peas 1 bushel, per acre; 1¾ acres, Algerian oats 2 bushels, and tares 1 bushel, per acre; 1¾ acres, Algerian oats 2 bushels, and tares ½ bushel, per acre; 1½ acres, Algerian oats 2½ bushels, and tares ½ bushel, per acre. The manure used was basic super, at 2 cwt. per acre.

The crops were all well up by the end of the month. The wheat came away faster than the oats, and the tares made better growth with the wheat than in the oat crops. The crops were ready for making into ensilage the first week in February, the grain then being in the putty stage, the peas podding, and the tares in bloom and coming to pod.

Cutting was started on 10th February. Two flat-top sledges were used for carting material to the stack, and the stacking was done with a mast and yard-arm and grapple hayfork worked by horse-power. The men employed were as follows: One on the mower, two to each sledge, two on the stack, one at the derrick, and a boy to lead the horse. The ground-measurement of the stack was 18 ft. by 17 ft. The first day's work built the stack up to 6 ft.; and on the 11th it was raised to 12 ft. 6 in. No work was done on the 12th, and on the morning of the 13th the stack had sunk to 9 ft., with temperature 120° F. On this date more material was added, and the stack rose to 16 ft. To give the stack time to settle down and develop the required temperature no work was done on the 14th and 15th. On the 16th the stack had receded to 10 ft., with temperature 140°. Material was added, and the stack rose again to 17 ft. 6 in. Bad weather then set in and rain fell almost continuously, making further work impossible until the 20th.

By this time the stack had sunk to 11 ft., with a temperature of 130°, but the silage had suffered no ill effects, the heavy rains having kept the temperature down. Material was then put on until the stack was 18 ft. high, and on the 21st it was weighted with 12 in. to 15 in. of earth. An amount of 4 cwt. of salt was used in making the silage.

Weights of the various green crops were taken, which worked out as follows: Wheat and tares, 13½ tons per acre; oats and partridge peas, 11¼ tons; oats and tares, 11¼ tons; and oats with reduced quantity of tares, 9 tons; or an average of 11¼ tons per acre over the whole area. Thus the green weight of material put into the stack was approximately 95 tons.

The stack was opened on 19th July, and cut out a sweet good-quality silage. The settled dimensions of the stack were 20 ft. by 18 ft. by 7½ ft., equalling 2,700 cubic ft., and the weight per cubic foot was 44 lb., or a total of 53 tons of ensilage. Allowing each cow a daily ration of .30 lb., this would feed a herd of forty cows for ninety-nine days.

FIELD-PEAS FOR FATTENING LAMBS.

T. W. LONSDALE, Manager, Moumahaki Experimental Farm.

In most parts of the Dominion rape is the principal forage grown for fattening lambs, but as on many old-established holdings the raising of a profitable crop of rape has become somewhat precarious it is being found necessary to substitute other fodders, and undoubtedly one which will eventually take a prominent place is peas.

The writer has always been an advocate of peas as a crop that should find a place on almost all arable land, and a short preliminary trial of the fattening-qualities of peas and rape respectively was carried out at this station last summer. Rape was sown on 15th October, and on the same day an adjoining plot of equal area was drilled with Partridge peas, both plots receiving similar treatment with regard to preparation and manures. On 2nd February a line of crossbred lambs by South-down rams was divided, and after marking and weighing equal numbers were placed on each plot. Previous to this date the lambs had not received any artificial food, but had been running on fresh pasture from weaning. The following shows the dates of weighing and average live weight per lamb:—

Lot 1 (rape): 2nd February, 58·65 lb.; 15th February, 65·80 lb.; 22nd February, 68·60 lb. Average gain per lamb, 9·41 lb.

Lot 2 (peas): 2nd February, 56·35 lb.; 15th February, 60·40 lb.; 22nd February, 69·30 lb. Average gain per lamb, 12·68 lb.

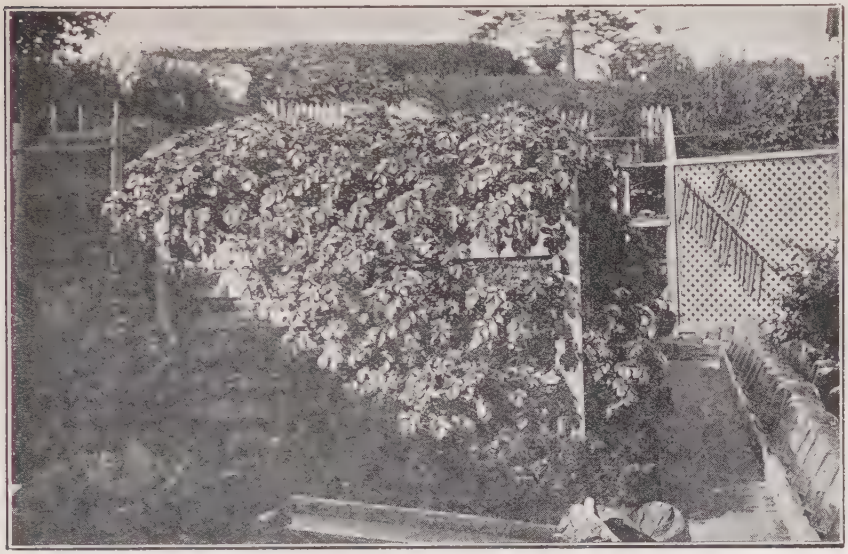
Gain in favour of peas, 3·27 lb. per head.

The lambs on rape made most headway during the first two weeks, which is accounted for by the lambs in lot 2 not taking so readily to peas, but the gain in weight of this lot during the third and final weeks was remarkable.

Preparations are being made to conduct a similar test on more extensive lines during the present season.

POTATO-GROWING IN LAYERS.

SEVERAL inquiries have been received lately regarding the growing of potatoes on the intensive system of layers, to suit conditions where only a very limited area of ground is available. A brief account of an experiment with this method by Mr. Gerald Fitzgerald, of Wellington, carried out last season in his back garden, in Tinakori Road, may therefore be of interest, although the result was largely of a negative character.



THE POTATO-GROWING CRATE IN MR. FITZGERALD'S GARDEN.

[*Photo, B. C. Aston.*

The potatoes were grown in what is practically a wooden crate in layers, each layer of the potatoes being separated by a layer of earth. In this way the potatoes grow outwards and upwards. The dimensions of the crate were 6 ft. by 6 ft. square and 4 ft. high; timber used was 3 in. by 3 in. totara posts for the upright corners, and the side battens were 3 in. by 1½ in. totara set on edge, leaving, therefore, 3 in. spaces through which the shaws of the potatoes grew. In sowing the potatoes the layer of earth occupied so much space that only the alternate spaces were occupied by the protruding shaws.

The sets were placed 6 in. from the sides, and were otherwise 12 in. apart. The whole was filled (in August, 1919) with layer after layer of soil and potatoes, with a light sprinkling of sulphate of potash. The soil was in good condition, neither too wet nor too dry. The

weight of the seed-potatoes was 28 lb., and the variety used was Sutton's Supreme, an early sort.

The crop was taken on 8th February. A slight second growth had been started. The total yield was 88 lb. Half of this came from the top layer—a large yield—and the balance from the outside sets in the several underlying layers. The inner sets produced nothing, some of them had disappeared, and a few had remained without movement. The quality of the yield was excellent—mostly large well-found tubers, and a few small ones—indicating that the soil was good and the cultivation suitable. The labour of making and discharging the crate, however, made the crop unprofitable, and this method of potato-growing is not recommended by the grower or the Department.

A good general idea of the crate and growing crop is given by the accompanying photograph.

SHEEP-MANAGEMENT NOTES.

II. CASTRATION AND DOCKING OF LAMBS.

F. MACKENZIE, Inspector of Stock, Christchurch.

THE castrating and docking of lambs is an important yearly procedure on farms where sheep are bred. There are various methods employed in different districts—in fact, as regards details, most sheep-farmers have their own methods of castrating lambs.

Ground and Location.—One of the most important factors connected with these operations is to have the work carried out on clean ground, and under no consideration should the lambs be marked on the same ground two years in succession. The reason for this precaution is that the ground is soiled with blood, and consequently becomes a propagating-ground for bacteria, especially the bacteria which cause blood-poisoning or septicæmia. The bacteria of tetanus, or lockjaw, must also be similarly guarded against.

The most suitable place is a clean grass-paddock, high-lying and well exposed to the sun. Low-lying and damp places should be avoided as far as possible. All bacteria must have moisture to keep them alive and multiplying, so that if the ground where the operation is carried out is wet or damp it may become a veritable incubator for the bacteria. On the other hand, ground in a high and dry position, well exposed to the sun, soon becomes clean, the sun's rays being the best disinfectant we have. On damp ground the moisture protects the disease organisms from the direct action of the sun's rays.

Conditions and Preparation.—Lambs should be castrated and docked when from three weeks to a month old. Marking lambs during the heat of the day or while heavy warm winds are blowing should be avoided as far as possible. The cool of the afternoon is the best time to carry out the work. For marking operations a few hurdles and coils of wire netting, together with a sufficient number of stakes,

should be held in readiness. With these a pen and yard can be erected in a suitable part of the paddock where the ewes and lambs are to be folded.

The instruments required consist of two clean, sharp knives, together with a bucket of water to which has been added some disinfectant. The hands of the person operating should be well scrubbed in a solution of the disinfectant before commencing operations. The knife when not in use should be placed in the bucket containing the antiseptic solution.

The Operation.—The method most often employed is as follows: The lamb is held by an assistant in such a position as to expose the pouch. The operator grasps the pouch at the tip and with one clean cut severs the end. The testicles are then pressed out and drawn. This is generally done with the teeth, but some operators prefer drawing the testicles with the fingers. If the cord should happen to be broken by rough handling before the testicle is properly drawn bleeding will be the result, and the blood collects in the pouch. This must be removed and the pouch washed out with an antiseptic solution. The reason for this is that if a blood-clot collects in the pouch septicæmia supervenes, and death follows. The testicles and pouch-ends should be placed in a receptacle provided for this purpose. As soon as castration is completed the tail is grasped and severed with one clean cut. The cut is best made two or three joints from the stump; the joint can be felt by the finger and thumb. A weak disinfectant should be applied to the wounds before releasing the lamb.

The knife used for tailing should be a separate one from that used for opening the pouch. The knives and operator's hands should be dipped into the antiseptic after each operation. After the work is concluded the tails, testicles, and pouch-ends should be collected and destroyed by fire.

After-care.—When marking operations are finished the ewes and lambs should be placed on good clean pasture with sufficient growth to keep the lambs' tails or pouch-ends from coming into contact with the soil. If these precautions are strictly observed any mortality from castration and docking should be reduced to a minimum.

Bleaching of Phormium-fibre. — During the past year a sulphur bleaching process has been tried at a few of the flax-mills in the Dominion, with the object of substituting it for the usual open-air bleaching. So far, however, the new process has not been as successful as anticipated.

Transmission of Earmarks.—Mr. J. W. Taylor, of Silverstream, reported last month the birth of a calf with its mother's earmarks, and this was confirmed by one of the Department's veterinarians who visited the farm. Such cases are of sufficient rarity to merit record. Similar occurrences have been previously noticed in the *Journal* for July, 1914, and September, 1916, the latter relating to the transmission of the earmarks of a bull to several of his progeny.

WORK FOR THE COMING MONTH.

THE ORCHARD.

FIRE-BLIGHT control work in the Auckland Province has been again taken up, and is under the general control of Mr. W. T. Goodwin, Orchard Instructor. All available permanent officers from the different parts of the country have been assembled and have been working in the affected areas, together with a number of temporary men. Up to the present this work has been in the nature of going over the ground previously covered (last summer and autumn), checking the work, removing infected and doubtful wood that may have been overlooked, and otherwise destroying all sources of infection as completely as possible. No indication of how successful the work has been is yet available, but the danger period is almost at hand, and with the blossoming of apple and pear trees the prospects of the immediate control or otherwise of the disease should be readily ascertainable.

Should an outbreak occur despite the work which has been done—and this is quite possible, owing to the average class of tree in the affected areas being such as to render detection difficult without careful search—the extent of such outbreak will largely determine the future policy. Should the outbreak be general, resembling that of last year, the staff will be immediately concentrated on the outskirts with a view to preventing its spread further afield. In the meantime the matter of more drastic action regarding the affected area will be determined; but should isolated outbreaks only occur the aim will be to immediately remove the affected parts of the trees attacked, and at the same time locate and remove the source of infection. In such cases this may be expected to be found in the form of a canker of the previous year's infection which has escaped detection.

Growers are earnestly requested to assist the departmental officers in stamping out the disease. Information as to how such assistance can be given (by cutting out and destroying cankered areas and disinfecting) may be gathered from a perusal of the article on fire-blight appearing elsewhere in this issue. Immediate notification of any outbreak should also be given to the local Orchard Instructor.

—*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

Cultivation: It is imperative that the plough be got to work at the earliest opportunity. The heavy growth of Lotus angustissimus experienced annually in the orchards in the northern districts makes this essential, and should the spring prove to be dry the work is only accomplished with difficulty.

Spraying stone-fruits: The early spring application will now have been completed. It is desirable in cases where brown-rot has been prevalent that an application of bordeaux, 3–4–40, or commercial lime-sulphur, 1–120, should be got on just at the time when three-fourths of the blossom-petals have fallen. The bordeaux is only recommended as a spray just at this period, and must be applied immediately at the time stated or not at all. Judicious thinning of stone-fruits is recommended as essential in materially lessening brown-rot.

Spraying pip-fruits: It is necessary to closely watch opportunity throughout this month to apply the first bud-movement spray, bordeaux 8–6–40, for control of fungoid troubles. This must be followed by bordeaux, 6–4–50, at the cluster-bud stage, and again later with bordeaux, 3–4–40, with the first arsenate (calyx) spray for codlin-moth—one of the most important operations in the annual programme of growers of pip-fruits. For successfully carrying out this work a high pressure is needed to force the poison well into the calyx-cup. This application is carried out immediately the bloom-petals have fallen and while the calyx yet remains open.

It is noticeable that many orchardists are not as careful as they should be in the application of arsenate-of-lead sprays—this first calyx-spray in particular. The calyx-cups are pointing at this period in all directions, and a thorough method is necessary to ensure good results. Every cluster of young fruit must receive the spray, and to do this the man with the nozzle should spray each tree from the four points of the compass—taking a stand at each point, thoroughly spraying the branches immediately opposite him and those at the other side of the tree which are facing towards him.

Strawberries: Growers are advised to spray with bordeaux, 4-4-40, keeping the foliage covered, for control of leaf-spot.

Citrus fruits: Owing to the irregularity in the growth and consequently in the blossoming of citrus trees (especially lemons this year) growers must judge individual cases, and put on their bordeaux, 5-4-40, when the spring growth has hardened, or 4-4-40 if the fruit has set before the growth hardens off. The abnormally cold weather, with many heavy frosts, has caused much damage to citrus trees, more especially lemons, where no covering was afforded. Attention should be paid to all affected trees, and all frosted parts cut away to a bud or lateral growth. This work is important, as dead wood resulting from neglect to carry it out will afford abundant opportunity for the entry of borer.

Manures: It is not yet too late to apply nitrogenous and phosphatic manures, but they should be got on without further delay.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Spraying will be the chief work of the month. With apples and pears the application of a fungicide in the early stages of the fruit-development is very important for the control of black-spot. Varieties not inclined to russet should receive an application of bordeaux, 3-4-50, at petal-fall. Varieties known to russet should receive bordeaux, 6-4-50, or lime-sulphur, 1-30, at the open-cluster stage (see last month's notes).

Keep a close watch for the first appearance of red mite; hatching may be expected about the petal-fall period. Lime-sulphur, 1-100, will kill, but only on contact; therefore make a thorough spraying, as all mites which escape at this period will cause renewed trouble later. Lime-sulphur at this strength may be applied with the arsenate-of-lead spray, but fresh lime of equal weight to the arsenate used should be added to the mixture to safeguard against scorching.

For codlin-moth arsenate of lead, 1½ lb. paste or 1 lb. powder to 50 gallons water, should be applied when the majority of the petals have fallen. Use good pressure and aim the spray towards the calyx-cup.

Most varieties of peaches will have set fruit, and spraying at this stage will consist of lime-sulphur, 1-125, as a precaution against brown-rot.

European varieties of plums should receive bordeaux, 6-4-50, at the cluster-bud stage to check the early development of rust. Japanese and hybrid varieties which have set fruit should be sprayed with lime-sulphur, 1-125.

Fire-blight: From the fall of bloom onward a lookout should be kept for fire-blight. Now that this disease has been found in the Auckland Province, orchardists in this district cannot afford to treat lightly any suspicious symptoms. With apple, pear, and quince all dead tips, twigs, spurs, or blossom-clusters, and bark eruptions or cankers, should be regarded with suspicion. With the aid of the growers it is hoped to promptly locate any sign of the trouble.

—W. H. Rice, Orchard Instructor, Hastings.

MOTUEKA.

Cultivation should be attended to and the soil kept in good tilth from now onwards. Cover-crops should be ploughed in where this has not already been done.

The fruit set will be well forward, and attention should be turned towards the prevention of diseases in the coming crop. The calyx-spray with arsenate of lead—using 1½ lb. paste or ¾ lb. powder to 50 gallons—should not be neglected on apples and pears. The application should be made as soon as the petals have fallen and before the calyx closes. This spray should be applied at intervals of about three weeks throughout the growing season of the fruit.

Twigs infected with powdery mildew should be removed and burned, and the trees thoroughly sprayed with lime-sulphur, 1-100 to 1-120.

Stone-fruit should be given every attention to prevent the ravages of brown-rot. The application of lime-sulphur, 1-125, is recommended.

Red mite may be effectually controlled at this period by the use of lime-sulphur at the strengths recommended, and every effort should be made to cope with it.

For control of black-spot on pears bordeaux, 3–4–50, may be used to advantage, but on account of the russeting effect of bordeaux on apples when used at this stage lime-sulphur is recommended for the latter.

On account of the fire-blight outbreak in the northern parts of the Dominion local growers are recommended to bring under the notice of the Orchard Instructor for the district any suspicious signs that may be taken for this disease in their orchards. —*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

Cover-crops turned under as suggested in last month's notes should be thoroughly decayed by this time, and the cultivation of the land can be proceeded with. Any manuring required should be carried out as soon as possible if results are to be obtained this season.

Grafting may still be carried on, although it is getting rather late. Watch the grafts as the season advances and cut off any unnecessary or surplus shoots, leaving only those required for the building-up of the tree.

With the appearance of these notes the majority of stone-fruits will have set their fruits, and care must be exercised with regard to the spraying. Bordeaux, even at a weak strength, is liable to burn fruit and foliage; therefore from this time onward lime-sulphur, 1–125, or atomic sulphur, 10 lb. to 100 gallons water, should be used. Leaf-curl will probably be the worst disease to contend with, and it is necessary to apply the spray under good pressure, especially towards the tips of the branches, where the curl usually makes its first appearance. Lime-sulphur will also do much to keep red mite in check. Green aphis does not appear to be very troublesome in this district, but black aphis is usually bad all through the spring and summer. If neglected considerable damage is done to the young growths, causing them to curl and stop growing. Apply Blackleaf 40, at strength 1–1,000, as soon as the aphis is noticed, and repeat at short intervals until pest is eradicated.

This is the most important time of the year for spraying for fungus diseases, especially black-spot on apples and pears. Should there be any varieties still in the pink stage an application of bordeaux, 6–4–50, should be applied at once. This should be followed after the fruit has set with an application of bordeaux at strength 3–4–40. Varieties of apples subject to russeting, and where spot has not previously been bad, may be sprayed with lime-sulphur at strength 1–100, testing the lime-sulphur before using and diluting accordingly, but bordeaux will give the best results on pears. Arsenate of lead may be added to the fungicide sprays for the control of codlin-moth, using paste 1½ lb., or powder ¾ lb., to 50 gallons. The addition of milk of lime (from 4 lb. to 5 lb. of fresh lime) will help to neutralize any free acid in the mixture and lessen the danger of burning. Should any powdery mildew be noticeable it would be advisable to cut off and burn the affected parts and spray with either lime-sulphur, 1–100, or atomic sulphur, 10 lb. to 100 gallons.
—*G. Stratford, Orchard Instructor, Christchurch.*

OTAGO.

Apple and pear trees will be in the pink stage of development by the end of September, and the treatment of the trees at this stage was fully dealt with in last month's notes. During October they will enter another phase, the blossoms will have fallen, and the young fruits commenced to form. Given suitable weather the air will be full of fungus spores of black-spot and powdery mildew, and fruit and foliage will need protecting from their attacks. Continue the applications of lime-sulphur, but at reduced strengths—1–80 to 1–100. Varieties such as Rome Beauty and Cleopatra are better for the greater strength owing to their predisposition to the disease and their comparatively good resistance to spray injury, but with most varieties it is well to reduce to 1–100 at this stage.

At this time the calyx of the fruit will not yet have closed, and the addition of arsenate of lead (paste or powder) to the fungicidal sprays is desirable in order to guard against codlin-moth. Though many consider this first application of arsenate of lead a waste in orchards comparatively free of codlin-moth, it is best to be on the safe side, especially in regard to early pears and apples, a large proportion of infected fruit being found to be attacked through the calyx. When using lime-sulphur and arsenate of lead in combination take care to dilute each compound separately with a good bulk of water, and then add together and apply

immediately, as chemical action sets up which is likely to cause damage if the mixture is allowed to remain too long in the tank before application. Standard brands of arsenate-of-lead paste give good results used at a strength of 3 lb. to 4 lb. to each 100 gallons of mixture, but only half this quantity of the powder is required.

Apple-trees will also need attention for the control of woolly aphis, colonies of which will begin to appear round the cuts and knots, especially where oil sprays have not been applied during the dormant period. Painting these parts with one part oil and two parts water will give good results; or add Blackleaf 40, at 1–800, to the fungicidal sprays and drive the spray well into cracks and crevices. Black and green aphis will also make their appearance about this time on peaches and nectarines; apply the Blackleaf spray, at 1–800, as soon as noticed, following up in a few days with another application. Very badly affected twigs are better removed and burned as soon as noticed, to avoid further infection.

Peach leaf-curl will be in evidence if weather is suitable to its development. It pays to pick off and destroy infected leaves and twigs to avoid its further spread and give the trees a chance to make new growths. Spraying with lime-sulphur, 1–140, will also help to check its spread, but stone-fruits are subject to scorch, and care must be exercised not to overdo this spraying on cropping trees.

As there were suspicions of brown-rot in the Teviot district during last season, I shall be glad if growers noticing any signs of this disease in their orchards will send notification of same at once, so that assistance and advice may be given in dealing with it. Any suspicious wilting or dying of pear-trees and apple-trees at blossoming and fruit-setting period should also be notified immediately, as this is one of the symptoms of the fire-blight disease now attacking fruit-trees in parts of the North Island. —*J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE end of October brings to a close the correct season for hatching out chickens of any breed. Therefore, if not already done, the last of the eggs should be put into the incubator or under broody hens at the earliest possible moment.

THE COLONY-HOUSE.

Where early hatching has been carried out the chickens will require to be moved from the brooder to the colony-house. In this connection every care should be taken to make the quarters fit to receive the young birds and to guard them against a set-back. See that the houses are thoroughly cleaned and sprayed with a good disinfectant, making sure at all times that no insect pests are present. Particularly does this apply to the red mite, which hides in cracks and crevices during the day and avoids any but the keenest observation. It attacks the birds at night by blood-sucking, and even adult stock cannot retain their health and vigour when being tortured with these parasites. It is therefore little wonder that young chickens cease to grow, and often die, when moved from the brooder to vermin-infested quarters. Lice of any kind should not be allowed to exist, particularly where young stock are concerned, and the only way of preventing these from making their appearance is by paying strict attention to cleanliness.

On no account allow the chickens to huddle in corners, or trouble may be surely anticipated. The huddling brings on sweating, and this makes the chickens susceptible to chill and colds immediately they go out-of-doors. It is common, but nevertheless a mistake, to try and harden the chickens off too rapidly after leaving the brooder. Any set-back at this stage means a serious check to healthy development. It stands to reason that when young chickens are taken from a cosy secluded brooder-quarter and placed in an open colony-house they will be encouraged to huddle in their endeavour to obtain the warmth and seclusion they have been accustomed to. When chickens are first put into a colony-house they should be provided with conditions similar to those they had in the brooder. A temporary hover should be provided, and arranged in such a way that the chickens can secure an ample supply of fresh air and at the same time be secluded. It is always a good plan to have the corners of a colony-house rounded off with wire netting, so that in the event of crowding the chickens at the back can secure fresh

air. For the first few nights the chickens require the most careful watching to see that the conditions are favourable to their development, especially when cold weather is being experienced. In addition to providing snug housing-quarters it is always well, where possible, to give the growing chicken a fresh run, preferably one that has been spelled for some time, and sown down with grass, clover, or rape, &c. Chickens will invariably thrive better on such a run than they will on stale ground.

COCKERELS AND PULLETS.

Do not neglect to separate the sexes as soon as possible. This will be to the advantage of both cockerels and pullets. It should not be forgotten that cockerels for the table and pullets intended for heavy egg-production require different treatment if the desired ends are to be achieved. The cockerels should be fed and managed in such a way that they will rapidly develop and be in a marketable condition at about four months and a half old. With this end in view, after the birds are three months old only soft food should be supplied. A mash composed of 50 lb. ground oats, 25 lb. ground wheat, 10 lb. maize, and 5 lb. meat-meal will make a suitable mixture. This should be moistened with milk or soup into a crumbly mass. Feed three to four times a day as much as the birds will clean up without waste. Green stuff, such as cabbage, lettuce, watercress, and chaffed lucerne or clover, &c., should be daily and liberally fed, while grit should be always in front of the birds to pick at. Where milk is available it should be given to drink in large quantities. As it is next to impossible to fatten cockerels on free range, they should be placed in confinement in a decent house, with a run giving opportunity for only limited exercise. The production of a maximum weight of flesh in a minimum period of time is the ideal to be aimed at when priming a table cockerel.

This is not the case with the growing pullet, which should be kept steadily growing and allowed to come to maturity in a natural way. Ample food should be provided, but not of a forcing nature, or the bird is apt to come to pre-maturity, and this is always undesirable. Meat, its substitutes, or skim-milk should be sparingly supplied. Indeed, when it is observed that pullets are showing signs of coming to maturity at too early an age these forcing-foods should be cut out of the ration. Good grain foods, of which crushed plump oats should form the bulk of the ration, together with an abundant supply of green material fed separately are the chief food-requirements of a growing pullet. It is not generally known that when a pullet commences to lay she ceases to grow. Obviously, if a bird commences to lay at a very early age it will be a diminutive specimen and a producer of undersized eggs. Generally speaking, it is better for a pullet not to lay before it is six months old.

THIN-SHELLED EGGS.

The production of thin-shelled eggs is a common occurrence at this season of the year. This is usually due to insufficient shell-forming material being supplied, or to the birds being overforced with meat, milk, &c., for egg-laying. As a preventive an ample supply of crushed oyster or other sea-shell should be always available for the birds to pick at. If this does not bring about the desired effect the only other safe course is to feed a less forcing ration.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

EXAMINING HIVES.

By this time all hives should have been carefully examined, and the condition of each duly noted. The objects of such examination should be to see that the bees have sufficient stores, a laying-queen, and freedom from disease. If on examination it is found that there is but little honey in the hive it will be necessary to feed liberally. If the apiary is free from disease it may be advisable to remove frames of sealed honey from those hives which have more than sufficient to carry them through, giving them to those deficient in stores. If this honey is not available it will be necessary to resort to sugar-feeding. In feeding sugar-syrup the best method is to use the division-board feeder, placing it as near the cluster as possible in weak colonies, and using equal parts sugar and water.

If no eggs or brood are found in a hive at this time of the year it is most probable that the queen is missing. In such cases it is advisable to unite such a colony to a fairly strong hive. Do not attempt to unite two weak colonies. In uniting, one of the best methods is to remove the cover and mat of a fairly strong colony, and place over the top a double sheet of newspaper. Then remove the queenless colony from the bottom-board and place it over the newspaper, giving no outlet for the bees in the top box. This should be done in the evening when the bees are quiet. They will soon get through the paper, and usually will unite quietly. If it is desired to unite a weak colony that has a queen this method may also be adopted, but it is advisable in this case to first remove the poorer queen.

If disease, such as foul-brood, is found it is necessary to treat as advised last month. Do not delay treatment, as the longer it is left the less chance there is of the bees recovering in time to be ready for the honey-flow.

SPRING MANAGEMENT.

Spring management is perhaps the most important problem of the beekeeper. On it depends to a large extent whether a good surplus of honey will be secured or not. The principal object is to build up the colonies, so as to have the largest possible number of worker-bees flying just when the main honey-flow commences. The time of the honey-flow varies according to locality, and beekeepers will need to study local conditions. In order to bring the hives up to the required state it is often necessary to start stimulative feeding. In such cases use two parts of water to one of sugar, feeding frequently in small quantities.

A good plan for stimulative feeding is to adopt outdoor feeding, but this is not advisable where other bees are within two miles of the apiary, as if nearer they would participate in the feast. If, however, circumstances are favourable for outdoor feeding it is necessary to have a large shallow trough or tank in which is placed a light wooden grating to float, so that the bees may not be drowned. The syrup should be very light, about eight parts water to one part sugar. In order to start the bees on it the syrup may be made about five parts water to one part sugar, and when the bees are working freely the strength should be reduced. It is advisable to have the feeder about 2 or 3 chains from the apiary, and feeding should be continuous when once started; or, if it is desired to stop, the vessel should be removed when empty, as otherwise the bees are apt to commence fighting round the empty feeder when the syrup is no longer available. It is important in outdoor feeding to use only very weak syrup, as advised. Colonies so fed, if at all strong, will very quickly build up, and the next problem will be to prevent swarming.

The best method to check swarming is to requeen as early as possible with young queens, giving each hive plenty of ventilation and room to expand. Frequent examinations of the strong hives and cutting-out of queen-cells will be necessary. The question of queen-rearing may be deferred till next month's notes, as generally it is too early to commence before November, except in the warmer portions of the Auckland Province. Preparation, however, may be made by encouraging drone-production in Italian hives, and building up one or two hives to a populous condition for the purpose of raising queens, when the weather is suitable.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

If a succession of broccoli covering a long period is wanted a number of varieties should be sown. The varieties are separated into sections—early, mid-season, and late. The chief difference in the varieties is the length of time they take to grow, early varieties coming to head in a shorter time than later kinds. This habit might lead to the supposition that a succession might be had by sowing the same variety at different times. That, however, would not answer. Unless a certain amount of growth is made before short days set in the heads produced would be very small, because they would be the produce of imperfectly developed plants. The fact of some varieties taking a longer time to head than others enables the starting of all while growing-conditions are good, and thus perfect development

is secured in each variety. Sowing should commence with early varieties about 15th September, mid-season two or three weeks later, and late varieties about the last week in October.

Leeks should be sown at once in all places, in shallow drills for transplanting at the end of December. In the colder districts carrots, parsnips, and red beet should be sown at once for winter use. In the warmer parts this sowing should be delayed till the first week in November.

Brussels sprouts are the most popular of all winter vegetables. They require a long season of growth to give their best, and seed should be put in at once. The young plants should be pricked off into beds of good soil as soon as they can be easily handled, spacing them about 4 in. apart. Plant finally, as soon as the plants are large enough, in rows 3 ft. apart, 30 in. between the plants. Everything that can should be done to induce a strong and sturdy growth. A good development of side leaves is necessary to the production of good sprouts. The side leaves should on no account be cut off until the sprouts are gathered.

Young celery-plants should be pricked off as soon as they can be handled, the smaller the better. Boxes with a depth of 2½ in. inside measurement are better than those that are deeper. Half fill the box with littery stable manure, and press it firmly down; then fill the box heaped measure with good rich compost, stroke it off with a lath, and press firm with a dry brick or piece of board. Prick the seedlings out 2 in. apart, well water, and place in semi-shade for a few days. Celeriac requires the same treatment.

Tomato seedlings should have been pricked out before now. Keep them in full light if in a house, or near the glass if in frames. Well ventilate on fine days. If air passes directly through the plants it will be to their benefit. The object should be to grow the plants tough and strong; there must be no coddling.

Turnips for succession should be sown as wanted, allowing seven to eight weeks between each sowing. The best plan is to sow a fresh bed as soon as pulling from the last begins. Sow lettuce thinly in lines and thin the plants to about 9 in. apart. This is a better plan than transplanting in hot weather, as it saves a lot of watering. Sow peas for succession, and French beans for the first time.

Runner beans also should now be sown. Beans of the old scarlet-runner type are perennial plants and do not require planting every year. The number of years it is profitable to leave them depends on the soil and the treatment they get. If the soil is of a free nature it will remain in good condition for many years, and if the plants are well fed they can remain. A plant will die here and there, but this can be made good by planting a seed-bean in the gap. Usually it is most profitable to let them stand only two years. The second year should show an increased crop of beans, but less growth in haulm. To grow them well prepare a trench as if for celery, but use a fair quantity of lime forked well into the lower strata of soil as well as in the top layer. In place of stable manure as used for celery decayed garden refuse may be used with a little bonedust mixed with it and a dusting of lime. Fill the trench with soil to within 6 in. of the top. Plant the beans in two rows 1 ft. apart in each row. When the plants are up set the sticks firmly in the trench on each side, and when they have run a foot or so up the sticks fill more soil into the trench, but still leave it a little hollow to facilitate watering.

Seedling beds of onions that are far enough advanced should be thinned, an operation that must not be delayed. It is easiest performed while the plants are small, and early thinning promotes good growth. The distance apart to leave the plants depends on the size of bulb required as well as on the quality of the soil, and personal observation is necessary to determine what is best. But it may be said that for market purposes medium-sized bulbs are most wanted, and, provided they are well harvested, will bring the best price; so that in most cases a single line should not be sought. Give nitrate of soda, ¾ oz. per square yard.

Potatoes.

Early potatoes should be sprayed with 4–4–40 bordeaux mixture, or a weaker solution, 2–2–40, may be used, provided spraying is taken up as soon as the tops are well above the ground and repeated every twelve or fourteen days. The spray should be regarded entirely as a preventive of disease, which is really all it is. It is very bad policy to leave spraying till disease appears. Difficulty in providing

fresh lime is causing some growers to substitute lime-sulphur for bordeaux. This is not recommended. If a quantity of fresh lime is placed in a barrel, slowly slaked, and then covered with water, it will keep without change for many years. Of course, this wet lime cannot be weighed out, but that does not matter. Use the proper weight of bluestone, add lime from the barrel, and test with ferro-cyanide of potassium. When no acid reaction takes place the mixture is right for use.

SMALL FRUITS.

Raspberries: Superfluous suckers should be suppressed by digging them out if possible, as then they are done with. They soon sprout again if hoed off.

Gooseberries and currants: It is quite common for a number of very strong shoots to break away from near the base of bushes. These if left become a nuisance later on, and they can be easily removed now by breaking them off with a downward push. In the case of black currants some of these growths may be wanted to replace worn branches. Such should, of course, be left alone.

Strawberries should be mulched before the fruit trusses are far advanced. The mulch is then easily applied and the plants grow over it and hold it in place.

Cape gooseberries should be planted at once except where heavy frost is likely to occur.

A GOOD GUERNSEY RECORD.

LEONIE III OF WOLLONGBAR, A MEMBER OF THE WERAROA GUERNSEY HERD.

Completed last month a testing-period of 365 days, with yield of 10,143·25 lb. milk, 579·92 lb. butterfat. Age at commencement of test, 4 years 321 days. One of a purchase of Guernseys from Wollongbar Experimental Farm, New South Wales, in 1916. Sire, Hayes Fido (imp.); dam, Leonie of Wollongbar. The Guernsey herd at the Central Development Farm (Weraroa) now includes eleven females.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

HEIFER WITH BLOOD IN MILK.

"SETTLER," Mayfield :—

I have not been able to use the milk of a heifer, calved two months ago, because in separating there is always blood left in the separator. Could you tell me the cause of this condition, and would it be advisable to have her come into profit again ?

The Live-stock Division :—

This condition is most frequently brought about by small blood-vessels in the udder rupturing, due to an intense congestion of the udder with blood after parturition. In this case there is no disease in the udder, but owing to the high blood-pressure the ruptured vessels do not readily close, and blood is observed in the milk for some time. In some cows the presence of blood in the milk is noticed only for a few days after calving and passes off without any treatment, in others it is more or less persistent and often resists treatment. Another cause of the trouble is a bruise or contusion of a quarter, due to an external injury. As regards treatment, give the heifer a drench consisting of ½ lb. Epsom salts, ½ lb. ordinary table salt, and 1 oz. ginger, dissolved in a quart of warm water and allowed to cool. In milking, do not strip the udder completely, in order to interfere as little as possible with the injured blood-vessels. Injections into the udder by means of a teat-siphon are not advisable, in view of the danger of setting up a worse condition—namely, mammitis, or inflammation of the udder. If the condition disappears, there is no reason to assume that the trouble will recur after next calving.

CHANGE OF SEED-WHEAT.

W. J. N., Waitahuna :—

Could you tell me if it is good practice to sow repeatedly the same wheat on the one farm without change of seed ? I purchased seed-wheat in 1916, and have sowed it four times now. I have been told by an old farmer that I should get new seed, by doing which I would get better yields. The wheat I have is Solid-straw Tuscan.

The Fields Instruction Branch :—

Wheat grown continuously on the same ground does not naturally deteriorate, and from this point of view there should be no objection to using seed from crops which have been grown on the one farm for a number of years. In practice, however, it often proves advisable to get new seed from time to time. This is not because the seed itself deteriorates, but because impurities have been introduced in various ways, such as by visiting threshing-mills. Impurities of other varieties of wheat are particularly referred to here. The result of the introduction of these varieties is that the seed-wheat is by no means pure after a number of years, and as impure seed will give plants which ripen at different times it is impossible to harvest in such a way as to obtain the best yield. A great proportion of the ordinary farmer-grown wheat is not pure, and it would be an advantage to make an effort to obtain pure seed-wheat—that is to say, a definite variety into which other varieties have not been introduced.

SHELTER-HEDGE FOR CENTRAL OTAGO ORCHARD.

"SHELTER-BELT," Dunedin :—

Can you suggest a suitable tree for a shelter-hedge around an orchard situated in Central Otago (Alexandra) ? The orchard is only a small one, so too much space cannot be given for headlands. Some variety that will not rob the soil too much or encroach on the fruit-trees is required. If possible I should like some subject that requires no attention in the way of spraying, pruning, or trimming. The soil is gravelly.

The Horticulture Division :—

You appear to be asking for rather too much ; you can hardly expect to obtain adequate shelter without giving some attention to the belt, and any tree must have sustenance. Either the Lombardy poplar or *Cupressus Lawsoniana* will come nearest to your requirements. The poplars may be planted 2 ft. apart, and the only attention required in pruning is to top the trees when they get too high. This is a very popular orchard-shelter in many places. *Cupressus Lawsoniana*, being evergreen and very dense in growth from the ground up, makes a warmer shelter. No trimming would be required for five or six years, after that some cutting-back would be necessary, but not trimming in the ordinary way. It may be planted from 30 in. to 36 in. apart.

ERADICATING OXALIS.

W., Auckland :—

I shall be obliged if you can suggest any method of eradicating oxalis.

The Biologist :—

The tuberous root *Oxalis cernua* is no doubt the species you refer to. This is a very troublesome one, particularly in gardens and orchards. In a small area the best way to eradicate it would be to fork it out, taking care to leave no bulbils in the ground. Fowls will eat the bulbils readily. Liming might be tried, as the plant prefers a somewhat sour soil. On a larger area of cultivated land fallowing combined with continuous scarifying, followed by harrowing and burning of the bulbils, &c., should be tried.

CALF-FOODS.

A. L. F., Mapiu :—

I would like to know what calf-food is recommended by the Live-stock Division for use with skim-milk. Last season I used crushed linseed with good results, but may be able to do better. Please state quantity per calf.

The Live-stock Division :—

There are a number of good calf-foods on the market, but the Department does not recommend any one in particular. As you state, good results can be obtained in feeding calves with crushed linseed. It has this drawback, however, that it contains too much fat in proportion to its other ingredients, and on this account it requires to be fed sparingly, or to be mixed with some other ingredient such as maize-meal or pollard. Crushed linseed-cake when fed to calves gives better results on the whole than crushed linseed. It should be steeped in boiling water for about twelve hours before being fed. A calf between three and four weeks old should have three to four tablespoonfuls of the paste with each meal, the quantity being gradually increased until two quarts per day is given.

TOP-DRESSING WITH LIME AND SUPERPHOSPHATE.

"NEWCOMERS," Koromatua :—

It appears to be the common practice in this locality when top-dressing with lime and superphosphate to mix the two prior to distribution. It is claimed that as good or better results are attained by this method as when the lime and the super are applied separately. Can you tell us if this practice is recommended, and, if not, the reason for the decision ?

The Fields Instruction Branch :—

We can recommend mixing lime and superphosphate just previous to top-dressing pasture, our experience showing that good results have been obtained by this method. The most important matter to consider when top-dressing with this mixture is that the work should not be done until after the winter rains are over. The top-dressing should be carried out as the spring growth is coming on, as super is quick in action and does not require so much rain as is the case with basic slag.

J. K., Raupo :— FEEDING SKIM-MILK TO PIGS.

What is the best way to feed skim-milk to pigs ? There seems to be a difference of opinion as to whether it should be fed direct from the separator or allowed to curdle for a day or two.

The Live-stock Division (Instructor in Swine Husbandry) :—

It is not advisable to keep skim-milk for two or three days to allow it to sour and curdle before feeding it to pigs, a certain amount of risk being attached to this practice. Some of the rheumatic complaints are traced to feeding sour milk to pigs, while intestinal disorders occur owing to the great amount of germs which congregate in the receptacles for holding the skim-milk. It is best to feed the milk as follows : Separate in the morning, feed at night ; separate at night, and feed in the morning. All barrels, &c., for holding the milk should be kept very clean and scalded out from time to time.

EARWIGS AND FRUIT-TREES.

"Orchardist," Alexandra :—

Would you kindly inform me what steps to take in order to prevent earwigs attacking stone-fruits ? They appear to hibernate in the ground, and in the spring ascend the trees, where they do considerable damage.

The Horticulture Division :—

Earwigs are night feeders. They conceal themselves during the daytime among dry rubbish on the ground, in crevices, in hollow trees—anywhere, in fact, where it is dry and dark. Fruit-trees that are properly looked after will afford no day shelter for the insects ; they must ascend the trunks from the ground every night. It should be possible to prevent them ascending the trunks by circling them with bands of sacking, the under-part being plastered with a sticky mixture, either fresh coal-tar or a mixture of fat and resin. The soil should be kept cultivated ; grass or rubbish of any kind will encourage earwigs.

GROWTH ON HORSE'S FOOT.

H. F. Louch, Ngatea :—

Will you kindly advise me as to the treatment for growths on the front foot of a young horse ? The growths first made their appearance when the animal was about a year old, and grew to the size of an orange. I cut them off three times with a knife and seared the roots with a hot iron, but this treatment has not altogether cured them, as they still grow to about the size of walnuts.

The Live-stock Division :—

These growths are somewhat difficult to remove, but we would advise you to apply corrosive sublimate and ground lime. Equal parts should be mixed together, and a little applied daily. Before applying the treatment the growth should be thoroughly cleansed by soaking the foot in a solution of disinfectant and water. Care will have to be taken to see that the powder does not spread to the surrounding tissues. A little vaseline or oil should be applied to the affected part in order to prevent this.

ERADICATING WINEBERRY.

"SLASHER," Te Puke :—

Would you kindly inform me as to the best time of the year and the most efficacious method of eradicating the second growth of makomako, known as wineberry ?

The Live-stock Division :—

The best method of eradicating this shrub is to cut it during January or February when the weather is hot and dry, and burn it immediately it has dried sufficiently. Makomako does not burn readily, and it should be fired only when the conditions for a clean burn are most favourable. Both sheep and cattle will eat makomako, and if the land is well grassed and stocked after clearing it will probably not give further trouble.

TURNIPS AND RAPE CROP.

"SWEDE," Masterton :—

Will you kindly advise me as to the proper method to employ in sowing turnips and rape together ?

The Fields Instruction Branch :—

This mixture is by no means a common one, but it has been successfully used for sheep-feed together with a little mustard. A suitable seeding would be 10 oz. soft turnips, 1½ lb. rape, and 1½ lb. mustard. Sheep will eat the rape and mustard first and leave the turnips till the last. Sowing of the mixture may be carried out from December to the middle of February.

CULTIVATING SWEDES.

"SUPERLATIVE," Ongaonga :—

Can you suggest any method of cultivating swedes when sown in large areas ? Would it be a good plan to sow them thick and then tine-harrow them across the drills ?

The Fields Instruction Branch :—

Swedes are usually best sown in drills 24 in. to 28 in. apart, and given intercultivation by means of the horse-hoe. If sown in 7 in. or 14 in. drills or broadcasted it is good practice to give them one or more strokes (according to thickness of the crop and condition of the land) of the tine harrows. Where possible the harrowing should be done across the drills.

The Cereal Position.—A communication issued by the International Institute of Agriculture in July last on the position of bread cereals (wheat and rye) states that "the outlook for the coming year may be summarized, so far as the present situation indicates, as one which does not justify any serious anxiety, either with respect to the needs of the importers or to the extent of available supplies in the exporting countries."

Conversion of Rock Phosphate into Superphosphate.—Superphosphate is made by treating the phosphate rock with sulphuric acid, the insoluble tricalcic phosphate being converted into soluble monocalcic phosphate, and calcium sulphate also being formed. Full details of the process will be found in standard works on fertilizer-manufacture. One ton of phosphate rock, by the addition of the necessary sulphuric acid, produces nearly 2 tons of superphosphate; the percentage of phosphoric anhydride in the superphosphate is therefore only about half that in the untreated phosphate rock.

REVIEWS AND NOTICES.

"DAIRY-FARMING IN NEW ZEALAND."

THIS is the title of the last of Messrs. Whitcombe and Tombs's half-crown series of "New Zealand Practical Handbooks" to reach us. The author of the little volume of a hundred pages or so, Mr. W. D. Powdrell, M.P. for Patea, is well known as one of the leaders of the dairy industry in Taranaki—one of the capable farmer-business-man type evolved out of the co-operative system of the past twenty years. Writing here from his own experience he has certainly maintained the practical reputation of the series. The book is a good plain statement of leading facts and conditions regarding our dairy industry of to-day, combined with common-sense advice on many points. The treatment is open-minded and non-dogmatic—in fact, one could in certain parts wish that the word "probably" occurred a little less often.

The scope of the work is indicated by chapters on the choice of a dairy farm; buildings; plant and equipment; breeds of dairy cattle; management and improvement of the herd; feeding of dairy cattle; the production and disposal of milk; dairy hygiene; economics of dairy-farming; pigs; and some common diseases of dairy cattle. This last section is by a veterinarian, Mr. A. A. Johnson, and forms a useful feature, while the matter on milk and dairy hygiene is credited in the preface to Mr. L. J. Wild, of Canterbury Agricultural College, although this is not indicated in the body of the work. Among other useful general matter is the text of a share-milking agreement, and the author has a good deal of interest to say about this system, which seems to be steadily increasing as a part in the economic development of the industry with its correlatives of expanding land-values and finance.

As in most of the other volumes of this series that have appeared, the *New Zealand Journal of Agriculture* is paid the compliment of being liberally quoted or referred to. In this case no less than forty-eight articles in the *Journal* are given under the heading of "For Further Reference" at the ends of the several chapters. Acknowledgment is also made of the loan by the Department of Agriculture of blocks of several illustrations and plans. The "well-known Government official" mentioned as the compiler of the figures giving the approximate annual cost of keeping and milking a cow, together with the resultant cost of producing butterfat in New Zealand, is not far to seek in an officer of the Department, whose researches on what may be called the internal economy of the dairy industry are not unknown to *Journal* readers.

A final chapter of "Don'ts for Dairy-farmers" contains some new and cogent points, but one reads with some surprise in a New Zealand work such items as "Don't water your milk and expect the manager to give you a greater test, as there is no fat in water." "Don't water your milk with a view to exchanging the same for your neighbour's whey, because he may not like it; besides, it is dishonest, and often small beginnings lead to big sentences." It may be observed—by the way, and also in lighter vein—that the book if anonymously written would almost betray its Taranaki source. For example, New Zealand is spoken of as a land of splendid roads; boxthorn hedges are given first place for shelter; while the ideal factory described on page 17 may be recognized as that of the co-operative dairy company whose chairmanship the author has so ably held.

A few statements in the book appear to have escaped revision. For instance, in the introductory chapter it is stated that the output of the dairy industry has been nearly doubled in the last half-dozen years. This would apply more correctly to the *value* of the output. A sentence on page 72 from which it might be inferred that the method of killing microbes in milk by heat is illegal also requires straightening-out.

"Dairy-farming in New Zealand" may be commended to *Journal* readers, and will be a useful addition to the farm bookshelf.

CORRESPONDENCE.

ALKALI SOILS AND IRRIGATION.

Mr. S. W. King, of Omanaia, Rawene, writes as follows:—

"On reading the article on 'Mortality among Stone-fruit Trees in Central Otago,' by Mr. G. H. Cunningham, in the *Journal* for June, I think it possible that my experience with irrigation in the Province of Mendoza, Argentina, may be of interest and possibly use to some of your readers. I was for some time manager of the Estancia La California, at Colonia Alvear, which belonged to Mr. John Nelson, of Buenos Aires. In this region, lying just to the east of the Andes, there is no rainfall with the exception of an odd thunderstorm of short duration in the summer, consequently all cultivated areas are entirely dependent on irrigation. La California was 550 hectares in extent (1 hectare = 100 metres square, or nearly 2½ acres), and the whole of this Mr. Nelson was planting in fruit-trees and grapes. Among other trees I planted about 50 hectares with New Zealand apple-trees, and nearly as much with the best varieties of New Zealand peaches. . . .

"Now, although I do not claim to have had any scientific training in the matter of irrigation, I certainly have had a lot of practical experience of it, and that with men who have been at it all their lives and know all that is known about it. From this experience I should say that Mr. Cunningham was quite correct in his finding that excess of water was the main cause of the disease. I should also say that this excess would also bring about the condition in the trees suitable for the attack of the fungus diseases mentioned.

"Irrigation is a very ticklish business and quite an art. It is also a matter that no one can advise on without a thorough local knowledge; but still there are some things you must do and some things you must not do wherever it is practised. For instance, wherever you irrigate you must also *desagua*—that is, you must have deep drains to run off the surplus water and keep the subsoil drained. Also, you should never hold water on the land and allow it all to soak in, but should run it over the land and run it off, allowing what will to soak in. Wherever you have what we called *salitre* in Argentina — probably the same as your alkalis—it is absolutely fatal to allow the water to stand on the land until it all soaks in. I have seen whole vineyards and plantations of peaches destroyed through carelessness in this matter, and the land become quite barren. This generally occurred in low places and hollows, which were looked upon there as very risky places to plant, although to the ordinary man they would look the best. I should say that the orchards in Central Otago, after being well drained, would benefit if irrigation was stopped altogether for, say, one season, or until the trees showed a real want of water. This will, of course, vary, and will depend on the soil, subsoil, rainfall, &c., but established trees with any depth of soil require very little irrigation even in the hottest and driest climates, provided the surface is kept well cultivated."

Importation of Fruit-trees into Australia.—A Commonwealth Proclamation, dated 28th July, 1920, prohibits the importation into Australia of pear, apple, or quince trees, or any portion thereof, which were grown in any country in which pear-blight (fire-blight) (*Bacillus amylovorus*) exists. New Zealand thus comes under the embargo.

Exportation of Live-stock from United States.—New York and Newport News have been appointed under the regulations of the Stock Act as additional ports for the exportation of horses, mules, and asses from the United States of America to New Zealand. Veterinarians in the employ of the United States Government for the ports named will be deemed appointed under the regulations for the inspection of such live-stock prior to shipment to the Dominion.

ANNUAL SHEEP RETURNS, 1920 (30TH APRIL).

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams*	649	898	4,332	974	3,773	2,919	13,545
Other rams	22,008	75,254	63,630	16,327	65,489	50,330	293,038
Wethers	343,269	869,112	1,020,166	225,348	670,956	772,324	3,901,175
Breeding-ewes	806,610	2,674,898	2,357,196	714,555	2,858,472	2,156,818	11,568,549
Dry ewes	189,054	604,563	450,016	56,719	246,306	275,626	1,822,284
Lambs	508,588	1,689,955	1,486,552	316,901	1,163,198	1,156,721	6,315,915
Totals, 1920	1,870,178	5,914,680	5,381,892	1,330,824	5,008,194	4,408,738	23,914,506
Totals, 1919	1,860,698	6,485,286	5,865,960	1,385,870	5,437,961	4,792,779	25,828,554

* Entered in Flock-books.

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1911–20.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Flock Sheep, and Sheep of Distinctive Breeds not entered in Flock-books.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1911	297,898	229,709	14,117	163,899	705,623	3,342,281	12,094,754	1,298,343	6,555,125	23,996,126
1912	306,588	232,782	11,563	155,498	706,431	3,359,969	12,044,247	1,324,200	6,315,306	23,750,153
1913	313,690	228,145	12,902	167,605	722,342	3,207,550	12,292,891	1,150,805	6,818,222	24,191,810
1914	321,869	229,055	13,526	170,169	734,619	3,211,661	12,691,121	1,152,749	7,008,613	24,798,763
1915	315,251	237,717	17,341	176,556	746,865	3,270,221	12,377,624	1,365,119	7,141,592	24,901,421
1916	310,131	252,201	15,012	175,155	758,499	3,478,263	12,040,566	1,189,023	6,721,799	24,788,150
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,583	154,376	9,733	109,347	580,039	3,901,175	11,414,173	1,812,551	6,206,568	23,914,506

NOTES.—(1.) Stud sheep returned since 1917 are only those entered in Flock-books. (2.) In the 1920 returns the Chatham Islands sheep are included at the figures of 1919, those of this year not being yet available.

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS IN EACH SHEEP DISTRICT (1920).

——	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-West-land.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in Flock-book)—									
Merino	..	..	..	..	4,972	8,476	2,593	16,041	16,041
Lincoln	2,463	5,970	22,321	30,754	908	1,587	1,715	4,210	34,964
Romney	9,654	11,659	67,654	88,967	7,836	9,708	32,959	50,503	139,470
Border Leicester	193	..	535	728	83	10,958	9,944	20,985	21,713
English Leicester	471	487	265	1,223	1,389	23,996	869	26,254	27,477
Shropshire	155	..	440	595	167	1,750	217	2,134	2,729
Southdown	299	2,223	8,103	10,625	128	5,374	161	5,663	16,288
Corriedale	..	..	555	555	1	21,848	4,795	26,644	27,199
Other breeds	172	1	226	399	37	665	19	721	1,120
Totals	13,407	20,340	100,099	133,846	15,521	84,362	53,272	153,155	287,001
Sheep of a distinctive breed but not entered in Flock-book—									
Merino	6,721	15,997	16,286	39,004	162,083	361,541	240,961	764,585	803,589
Lincoln	14,042	126,437	113,100	253,579	3,901	8,025	8,527	20,453	274,032
Romney	228,370	1,109,711	1,046,576	2,375,657	103,207	88,668	405,307	657,182	3,032,839
Border Leicester	2,346	2,612	5,218	10,176	393	61,614	69,977	131,984	142,160
English Leicester	2,471	296	1,394	4,161	12,789	124,901	8,586	146,276	150,437
Shropshire	1,946	70	753	2,769	869	3,604	1,870	6,343	9,112
Southdown	534	6,396	19,600	26,530	109	5,339	437	5,885	32,415
Corriedale	43	162	7,735	7,940	1,877	254,811	176,408	433,096	441,036
Halfbreds	..	..	..	..	151,295	740,656	250,508	1,142,459	1,142,459
Other breeds	557	245	1,078	1,880	1,171	11,179	163	12,513	14,393
Totals	257,030	1,252,926	1,211,740	2,721,696	497,694	1,660,338	1,162,744	3,320,776	6,042,472
Crossbreds and others not otherwise enumerated	1,599,741	4,641,414	4,070,053	10,311,208	817,609	3,263,494	3,192,722	7,273,825	17,585,033
Grand totals ..	1,870,178	5,914,680	5,381,892	13,166,750	1,330,824	5,008,194	4,408,738	10,747,756	23,914,506

THE BEET-SUGAR INDUSTRY.

VICTORIAN EXPERIENCE AT MAFFRA.

[The article which follows is by Mr. W. L. WILLIAMS, manager of the beet-sugar factory at Maffra, operated by the Government of Victoria. The matter was published recently in the *Journal of the Department of Agriculture* of that State, and has since been issued in pamphlet form. It is now reprinted in these pages for general information, Victorian conditions being perhaps nearest generally to those of New Zealand in regard to this branch of agricultural industry. With the recent enormous appreciation in the market value of sugar the long-standing proposals to establish the beet-sugar industry in New Zealand have entered on a new phase, and it is hoped shortly to deal with the subject in the *Journal* more directly in relation to our own conditions. The results of assays of sugar-beets grown last season in various parts of the Dominion will be available for publication in next month's issue.—EDITOR.]

WHY THE INDUSTRY SHOULD BE DEVELOPED.

THE world's beet-sugar industry was launched in the beginning of the nineteenth century, and has made such rapid and sound progress since then that just prior to the Great War it was responsible, under white labour, for approximately half the world's production of sugar, and for a remarkable increase in the production of cereals and in the rearing of stock wherever the industry was established. Its greatest stronghold has been, and still is, in Europe.

It was introduced to America with some trepidation, because of the competition that had to be met from the many adjacent cheap-labour cane-sugar areas, and of the necessity for meeting higher costs of material, and the employment of a more independent and costly class of labour. In spite of these difficulties the industry has developed there to such an extent that it now produces about 75 per cent. of the sugar grown in the United States, and its economic and decentralizing value has become so evident that the Government is energetically using every reasonable means to encourage its expansion.

Its value to America, where labour and other conditions are very similar to our own, is probably the best index of what it might become to the temperate zones of Australia if rightly encouraged and developed. There has been some question as to whether Australia might not produce too much sugar should further factories be established, but such a view makes no allowance for the progress we have every reason to expect. To allay any fears, it may be of interest to mention that recently much anxiety was expressed as to how a surplus of cane-sugar produced in 1917–18 in Queensland might be disposed of, and factory extension was promptly discouraged; yet inside of twelve months the expected surplus had resolved itself into a shortage, and we are now actually importing sugar, and are likely to do so for some years to come.

For national strength and safety, and in justice to the cramped European races requiring more favourable living-conditions and better opportunities, it appears to be a duty as well as a privilege to rapidly expand our population, and thereby increase our production and consumption of foodstuffs, of which sugar is such a necessary and increasingly important item. Our preserved fruits, condensed milk, and confections are winning increased favour and demand at home and abroad, and these will absorb largely increasing quantities of sugar. Furthermore, the world to-day is short of sugar to the extent of 3,000,000 tons a year, with a growing demand, equal to about 10 per cent. per annum, as people are coming to realize that sugar, once a costly luxury, is now undoubtedly a cheap and most effective energy-producing food.

Most of all, the economic advantages due to the encouragement of such country industries as the beet-sugar business; which rapidly intensifies all other production and adds to the wealth and comfort of producer, labourer, and consumer, must attract the thought and attention of those who desire to develop our great resources to the best advantage.

For these reasons the beet-sugar industry, with its favourable white-labour conditions, is likely to hold a strong position in the production of what we might rightly term a staple food-product, and in the promotion of closer settlement and intense farming.

A BRIEF ACCOUNT OF SUGAR-BEET GROWING IN VICTORIA.

It will not be out of place to touch very lightly on the genesis of the beet-sugar industry in Victoria. Its difficulties and discouragements may act as danger-signals against faulty methods, while the advantages observed may help to pilot any extension of this valuable industry along safe and successful lines.

From 1866 until 1898 the industry in Victoria was toyed with in a perfunctory way without any success from a manufacturing point of view, though some sugar was actually manufactured at the Anakies Mill in 1873. Some very useful and promising experiments were carried out in the growing of sugar-beet, chiefly in Gippsland and the Western District, indicating that our climatic and soil conditions are reasonably favourable. Very successful plots, both as regards tonnage and sugar-content, were grown in the Port Fairy, Narre Warren, and Maffra districts, and more recent experiments tend to confirm the opinion that Victorian conditions are generally favourable to the growing of beet.

The districts with a suitable rainfall, however, at present offer the most favourable field for the extension of the industry, though, taking into consideration the question of sugar-content, surety of yields, and convenience of handling the beets in the drier areas under irrigation, irrigable areas may eventually prove most desirable. At one time it was thought that irrigation would be detrimental to sugar-content, but in actual experience it is found that an abundance of moisture applied in the early-growing period, with comparatively dry and sunshiny conditions towards maturity, is more conducive to high purity, good sugar-content, and regular yields than those uncertain, irregular climatic conditions which so often result in a dry growing-period, with excessive rains at maturity, thereby producing low-grade beets. Victoria has not yet had occasion or opportunity to broadly determine which is the more favourable; but, as in America, it is likely that both irrigable and good rainfall areas will produce profitable beets, the irrigated areas being more costly but more reliable than the non-irrigated.

The fact that numerous but small test-plots right back in 1887-90 indicated favourable possibilities for beet-sugar growing was not sufficient to prove that the industry under ordinary business conditions, where all manner of contingencies and difficulties have to be met and allowed for, could become a financial and commercial success; and in 1898 the industry was put to a definite and what was expected to be a fairly complete test.

After some years of organizing, a company was formed, and a substantial and well-equipped factory was constructed at Maffra, said to be capable of treating 400 tons of beets per day. A considerable area of beet was planted in the spring of 1897, but a dry summer was experienced. In the autumn of 1898 the factory treated some 9,000 tons of beets, yielding 504 tons of white granulated sugar, as well as a quantity of raw sugar and molasses. The sugar found a ready market, but the season ended with a heavy loss, and growers generally seem not to have secured profitable yields at the low rates then prevailing for beets. The factory operated for a second season, and treated the product of 1,500 acres, or some 6,000 tons of beets, for 307 tons of sugar. Neither field nor factory results were satisfactory, and the accumulated losses of the two seasons were such as to compel the company to suspend operations, while the growers were far from successful with their crops. At the same time there were definite indications that a well-managed factory operating to capacity should produce a high grade of sugar, and run profitably; and in the field some of the crops proved that profitable yields of high-grade beets could be grown under right conditions.

The failure seems chiefly to have been due to insufficient rainfall, accentuated by inexperience and faulty cultivation, and inefficient business and technical control in the factory, resulting in costly running and a low extraction of sugar. Excepting the climatic influences, the other reasons for difficulties during the initial stages of this new industry were to be expected, and a longer experience should gradually have eliminated them. The adverse influence of a light and erratic rainfall could certainly have been modified by better methods of

cultivation, but climatic conditions were undoubtedly responsible in the main for failure. At this stage the plant and buildings had cost the company, approximately, £75,000; and, as the Government had advanced the company £63,000, it took possession, and retained the mill inactive, but in good order, for a term of ten years, during which time a number of experimental beet crops were grown in the district. Owing to a revival of interest by the Government and district farmers, Dr. Walter Maxwell was, in 1909, invited to report on the industry and its possibilities. He recommended that the factory be reopened as an experimental concern, and be supported by the Government until such time as beet-growing should develop sufficiently to enable the mill to be placed on a commercial and profitable basis. An American manager was appointed, and the mill reopened in 1910, under the control of the Department of Agriculture, with the following results:—

1910–11.—458 acres were harvested for 5,970 tons of clean beet, producing 482 tons of sugar, and a quantity of molasses and beet-pulp very suitable for stock-feed. The rainfall was exceptionally good, and the price paid for beets was 16s. per ton. With the heavy expense of reopening, and the small turnover, the factory was naturally run at a loss.

1911–12.—752 acres were harvested for 3,975 tons of beet, producing 519 tons of sugar. The Boisdale Closer Settlement Estate became associated with the industry by agreement that each block should provide 10 acres of sugar-beet per annum. Owing to the unavoidable late preparation, and a dry-growing period, the crops were disappointing, and the factory was operated at a loss. The price paid for beets was £1 per ton, plus a bonus of 5s. 4d. granted to offset the low yields, and because of the high sugar-content of the beets.

1912–13.—900 acres were harvested for 6,208 tons of beet, producing 648 tons of sugar. The season was dry until harvest-time, and rain came at a period when it reduced the sugar-content without materially increasing the tonnage. The price paid for beets was £1 per ton. On 31st December, 1912, the assets were taken at an operating valuation, and a first balance-sheet was prepared for the six months ending 30th June, 1913, as follows: Liabilities at 30th June, 1913, £86,276 14s. 11d. Assets—Land, plant, equipment, &c., £64,647 2s. 5d.; debtors, &c., £4,377 5s. 10d.; stocks, £13,673 6s. 2d.; loss, half-year, after charging interest and depreciation, £3,579 0s. 6d.: total, £86,276 14s. 11d.

1913–14.—1,000 acres were harvested for 7,432 tons of beet, producing 920 tons of sugar. The price of beets was 23s. per ton. Another dry period was experienced, and the compulsory growing of beet on both the Boisdale and Kilmany Closer Settlement Estates was discarded, as they were found unreliable without irrigation. Beet-growing by the factory was also discontinued. Where irrigation was tried the results proved most satisfactory, but the settlers did not then show sufficient interest to encourage the Government to proceed with an irrigation scheme. Liabilities at 30th June, 1914, £100,906 17s. 7d. Assets—Land, plant, equipment, &c., £63,927 6s. 7d.; debtors, &c., £3,309 15s. 5d.; stocks, £19,786; profit and loss account, £3,579 0s. 6d.; loss for year after interest and depreciation, £10,304 15s. 1d.: total, £100,906 17s. 7d.

1914–15.—990 acres were harvested for 8,843 tons of beet, producing 1,182 tons of sugar. The price of beets was 23s. per ton. Although a dry year, a very favourable fall of rain during the growing season occasioned a satisfactory crop, but it was estimated that 1,500 tons of beets were diverted for stock-feeding purposes. Liabilities at 30th June, 1915, £107,657 5s. 9d. Assets—Land, plant, equipment, &c., £61,678 0s. 9d.; debtors, &c., £3,927 8s. 10d.; stocks, £25,382 10s.; profit and loss account, £13,883 15s. 7d.; loss for year, after interest and depreciation, £2,785 10s. 7d.: total, £107,657 5s. 9d.

1915–16.—461 acres were harvested for 4,928 tons of beet, producing 560 tons of sugar. Owing to local difficulties, and the uncertainty of seed-supplies coming to hand under war conditions, only a small acreage was planted, but the financial result was comparatively good. The price paid for beets was 25s. per ton. Liabilities at 30th June, 1916, £96,663 8s. 9d. Assets—Land, plant, equipment, &c., £57,007 10s. 10d.; debtors, &c., £2,842 13s. 5d.; stocks, £16,955; profit and loss account, £16,669 6s. 2d.; loss for year, after interest and depreciation, £3,188 18s. 4d: total, £96,663 8s. 9d.

1916–17.—1,320 acres were harvested for 15,159 tons of beet, producing 1,948 tons of sugar. The price of beets was 27s. 6d. per ton. Floods destroyed some 300 acres of the area planted, otherwise the season was good, and the factory was enabled to run to much better advantage on the impoved tonnage, showing a profit of £8,013 13s. 2d. Liabilities at 30th June, 1917, £121,159

os. 1d. Assets—Land, plant, equipment, &c., £57,179 16s. 4d.; debtors, &c., £1,615 12s. 5d.; stocks, £50,519; profit and loss account, £19,858 4s. 6d.; profit for year, after interest and depreciation, £8,013 13s. 2d.: total, £121,159 os. 1d.

1917–18.—1,200 acres were harvested for 14,487 tons of beet, producing 1,650 tons of sugar. The price of beets was 27s. 6d. per ton, and the yield satisfactory. The sugar-content, owing to climatic conditions and somewhat doubtful seed, was low, thereby modifying the production of sugar and the profits. Liabilities at 30th June, 1918, £109,139 2s. Assets—Land, plant, equipment, &c., £54,968 11s. 6d.; debtors, &c., £2,138 10s. 8d.; stocks, £42,055; profit and loss account, £11,844 11s. 4d.; profit for year, after interest and depreciation, £1,867 11s. 6d.: total, £109,139 2s.

1918–19.—1,009 acres were harvested for 12,289 tons of beet, producing 1,263 tons of sugar. The price of beets was 27s. 6d. per ton. Although the tonnage was satisfactory, a dry spring and summer, followed by a wet autumn, was responsible for an abnormally low sugar-content, which very adversely influenced the sugar-yield and financial results. Liabilities at 30th June, 1919, £104,188 19s. 11d. Assets—Land, plant, equipment, &c., £52,909 12s. 8d.; debtors, &c., £4,101 17s. 2d.; stocks, £35,418 13s. 6d.; profit and loss account, £9,976 19s. 10d.; loss for year, after interest and depreciation, £1,781 16s. 9d.: total, £104,188 19s. 11d.

Analysis of Profit and Loss Accounts.

Year.	Capital.	Receipts, including Increase or Decrease in Stock.	Expenditure.	Profit.	Loss.
	£	£	£	£	£
1912–13 (6 months) ..	76,416	14,557	18,136	..	3,579
1913–14	79,432	22,630	32,935	..	10,305
1914–15	79,520	28,766	31,552	..	2,786
1915–16	78,682	22,406	25,595	..	3,189
1916–17	81,391	54,510	46,496	8,014	..
1917–18	81,708	53,346	51,478	1,868	..
1918–19	82,068	41,361	43,142	..	1,781
		237,576	249,334	9,882	21,640
Deduct profit ..		..	..	..	9,882
Net loss to 30th June, 1919 (after charging interest and depreciation amounting to £39,210)					11,758

Year.	Details of Expenditure.						
	Salaries and Wages.	Purchase of Beet.	Materials, &c.	Other.	Depreciation.	Interest, 4 per Cent. on Capital.	Total.
	£	£	£	£	£	£	£
1912–13 (6 months)	4,098	4,345	3,682	3,085*	1,430	1,496	18,136
1913–14 ..	6,562	8,532	4,568	6,681†	3,536	3,056	32,935
1914–15 ..	7,644	10,170	4,883	2,662	3,016	3,177	31,552
1915–16 ..	5,688	6,064	4,008	3,500	3,154	3,181	25,595
1916–17 ..	8,147	20,286	8,437	3,942	2,537	3,147	46,496
1917–18 ..	9,227	19,463	13,200	3,794	2,528	3,266	51,478
1918–19 ..	8,582	16,319	7,929	4,626	2,418	3,268	43,142
	49,948	85,179	46,707	28,290	18,619	20,591	249,334

* Loss on cultivation, £690. † Loss on cultivation, £2,736; duty and charges, £1,804; contour survey, £300.

In the above period of six years and a half, from 1,000 acres per annum the Government has been fully reimbursed all costs and expenses, has received £20,591 interest, as well as £6,861 cash towards the depreciation reserve, instead of £18,619 charged.

Maffra Sugar-factory Manufacturing Results.

	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Acres harvested ..	458	752	900	1,000	990	461	1,320	1,200	1,009
Beets worked (tons) ..	5,970	3,975	6,208	7,432	8,843	4,928	15,159	14,487	12,289
Percentage sugar in cossettes	13·9	19·2	14·5	17·1	17·2	15·45	15·85	14·45	13·49
Percentage purity ..	85·0	87·8	83·0	85·6	84·7	85·7	85·9	80·5	82·0
Sugar produced (tons)..	482	519	648	920	1,182	560	1,948	1,650	1,263
Percentage extraction..	8·06	13·06	10·44	12·39	13·36	11·37	12·85	11·39	10·28
Molasses produced (tons)	..	266	362	435	468	251	480	344	460

Maffra Factory Rainfall Records.

	April to September.	October to March.		April to September.	October to March.
	Inches.	Inches.		Inches.	Inches.
1910–11 ..	8·96	19·64	1915–16 ..	7·65	12·61
1911–12 ..	9·71	6·97	1916–17 ..	11·91	11·82
1912–13 ..	9·19	12·19	1917–18 ..	9·36	15·45
1913–14 ..	9·34	8·88	1918–19 ..	13·37	9·47
1914–15 ..	6·96	7·62	1919-20 ..	11·91	..

OUTLINE OF BEET-SUGAR MANUFACTURING PROCESS.

The weighed beets are sampled, and a percentage determined and deducted for dirt and improper topping. They are dumped from tip-drays, or unloaded from trucks into V-shaped bins. Water-flumes underneath these bins convey the beets to a large beet-wheel, which lifts them into a mechanical washer, where, by agitation and a large supply of water, the adhering dirt is removed. The beets are then carried over to a bucket elevator, which drops them into a beet-slicing machine, where they are cut into fine grooved shreds or cossettes. These cossettes are conveyed to a diffusion battery of fourteen cells, where, by the circulation of hot water, the sugar is diffused from the slices in the form of a sweet juice, and the exhausted cossettes remain as an ideal stock-food, termed "beet-pulp."

Good average beets should test 15½ per cent. of sugar, at a purity of 85 per cent., and yield 12¾ per cent. of refined white sugar, the balance remaining partly in the final molasses, while a percentage is lost in process.

The diffusion juice is heated and run into carbonatation-tanks, where it is treated with lime-milk and carbon-dioxide gas drawn from the lime-kiln. This is the chief refining process, the impurities being largely decomposed and precipitated, and the juice sterilized.

The lime with the impurities is removed by forcing the juice through frame filter presses lined with double layers of cotton duck. The juice is given a second carbonatation and filtering, and is then run to the sulphur-tanks, where it is treated with sulphurous acid, and well heated to further purify and clarify it. Following another filtration, the thin refined juice is taken to the quadruple-effect evaporators, where the excess moisture is removed by boiling under the influence of a vacuum. The concentrated juice is filtered and taken to a large vacuum-pan, where it is boiled to a mass of sugar grain and molasses, termed "melada." This melada is run into high-speed centrifugal machines, whereby the molasses is separated from the sugar-crystals, which are washed, dried in a granulator, and bagged ready for consumption. Eight tons of good-quality beets effectively treated should produce 1 ton of white granulated sugar.

The first molasses is reboiled for a second-grade sugar and molasses, and this sugar is mixed with the fresh juices and further refined to white sugar. The second molasses is either reboiled for a third sugar, or, if final, is sold as stock-food molasses, or used for the manufacture of methylated spirit.

The Maffra factory cuts about 200 tons of beet a day, but with increasing costs of material, labour, &c., it would naturally run to much greater advantage

if remodelled on a 500-ton basis. Large quantities of coal, bags, filtering-material, lime-rock, and manufacturing supplies are used. About 140 men are required for factory operations. All mechanical repairs are effected on the spot, as the plant has to run continuously day and night for three or four months. The technical results are carefully watched, and manufacturing results regulated throughout by comprehensive chemical analyses.

A live sugar-factory stimulates a country district to a remarkable degree, and is a great acquisition, attraction, and advantage to all parties, particularly to the farmers' sons, as it disturbs the ordinary monotony of farm life and offers them interesting employment.

Wholesale sugar-prices since the reopening of the factory have been approximately as follows: 1910, £22 12s. 6d.; 1911, £22 12s. 6d.; 1912, £22 12s. 6d.; 1913, £22 2s. 6d.; 1914, £21 2s. 6d.; 1915, £25 12s. 6d.; 1916, £29 7s. 6d.; 1917, £29 7s. 6d.; 1918, £29 7s. 6d.; 1919, £29 7s. 6d.

BY-PRODUCTS OF THE BEET-SUGAR INDUSTRY.

These are important, and are of particular value to any district interested in stock-raising and dairying.

Beet-tops.

Commencing in the field, the beet crowns and tops may be siloed or fed green or dry, and they are generally considered worth the rental value of the beet land. They are *ideal* for fattening stock.

A thrifty, far-seeing farmer would probably elect to plough them in, thereby restoring valuable mineral matter and humus to the soil. In this way the fertility of the soil may be well maintained, as by far the greater part of the plant-food is to be found in the crown and leaves.

A 20-ton crop of clean beets per acre contains plant-food as follows: In topped beets—Potash, 152 lb.; nitrogen, 60 lb.; phosphoric acid, 36 lb.; soda, 24 lb.; lime, 16 lb. In crown and leaves—Potash, 235 lb.; nitrogen, 113 lb.; phosphoric acid, 80 lb.; soda, 199 lb.; lime, 208 lb.

It is evident that it must pay to plough in the tops, though to feed them off in the field with sheep and so return these plant-foods in the form of manure has been found more profitable and good policy, providing the stock are withdrawn during wet weather.

Beet-pulp.

Beet-pulp consists of the beet-slices exhausted of their sugar, and is a most valuable by-product. It represents about 85 per cent. of the beet, but loses a lot of weight when stored. It may be used immediately, or run into large open silos for use throughout the year. Dairymen use it very freely, as it has been found to stimulate milk-production to a marked degree. It is evidently far more valuable as stock-feed than its analysis indicates, being very succulent and exercising a stimulating and wholesome effect upon the digestive organs.

It should be fed with lucerne, other hay, or chaff to secure the best results and a well-balanced ration. Dairymen feed pulp at the rate of about 56 lb. per day per cow, and it has not merely saved stock, but has kept many herds in profit-making condition during drought periods in the Maffra district. It is sold at from 2s. 6d. to 5s. per ton.

The siloed pulp rapidly ferments or matures, and in such state is found to be a more valuable stock-food, though rather unpleasant to handle.

So long as a factory has capacity and demand enough to hold its beet-pulp in a wet state it is probably wise and economical to do so, for the cost of drying is very heavy and only worth consideration when the quantity is very large and the local demand limited. The cost in fuel and plant to reduce the pulp from 89 per cent. of moisture to 10 per cent. is so high that it should only be considered for such surplus pulp as is not required for local use. Where large quantities are available the convenience in storage and distribution of dried pulp is undoubtedly attractive, and in America it has a wide distribution and a ready sale at high prices.

In Maffra the demand for wet pulp for use during the dry months is now far ahead of the supply, and it is a valuable support to the dairying industry.

Molasses.

Molasses is an important by-product containing 48 to 50 per cent. of sugar not readily crystallizable. Although not so pleasant to the taste as cane molasses, its feeding-value is good, and it is largely used for stock-feeding

purposes with great advantage. Quantities are also used by distillers for the manufacture of methylated spirit.

Where the quantity of molasses is large enough to warrant a heavy outlay on plant it may be treated by the "Steffen's" process for the extraction of the greater part of its sugar, and the residue is then frequently evaporated for its potash, now so valuable.

Lime-scum.

Lime-scum is the waste lime remaining after the refinement of the beet-juices, and in process it has absorbed an amount of organic and other useful fertilizing-matter. After it has dried out sufficiently to handle it may be spread with great advantage on heavy and sour lands, improving the physical condition of the soil, correcting acidity, and making more readily available the mineral plant-foods in the soil.

Many farmers seem not yet as interested as they should be in the value of lime, particularly for the maintenance or restoration of the fertility of their continuously cropped areas. Where a sugar-mill is rightly located the lime-scums may be run off with the large quantities of waste water and used for irrigation purposes. Spreckles' large sugar-mill in California distributes the waste water and lime in this way over miles of country, and it has a very favourable influence on the heavy adobe soils.

Sundries.

Waste ashes and cotton filter-cloths find much useful service, and a beet-sugar factory economically run and rightly appreciated may turn its products and by-products to full advantage, the by-products in particular being a great support to stock and dairy farming.

SUGAR-BEET GROWING.

Successful beet-growing calls for good soil, intense culture, and suitable climatic conditions. No firm rules can be prepared to meet the varying conditions under which beet may be grown, and every farm and every season has its peculiarities, demanding keen individual attention and frequently modified methods.

Climate.

While the wild beet finds its home on the sea-coast areas of tropical climates the improved sugar-beet gives the most satisfactory results in temperate climates.

Soil.

Although beets are grown on a variety of soils, it is advisable here to select the best land with a view of securing good yields that will more easily bear the high costs of production. When the industry is thoroughly established beets may be grown on poorer lands for the indirect advantage of improving such soils for other crops. The intense culture and deep-rooting habits associated with beet-growing will undoubtedly, as in Europe, have a valuable influence on the fertility and production of our second-rate soils.

Rich sandy or silty loams and heavy loams with a good depth of soil and comparatively free subsoils are desirable. A good-type beet must root deep, so that waterlogged areas and soils with an impervious hard-pan near the surface are unsuitable unless such faults are corrected. Raw peat lands are not desirable. Sandy heath lands often produce impoverished or stunted beets high in sugar-content.

Cultivation.

Where convenient, the beet-land should be deep-ploughed, or ploughed and subsoiled, in the autumn up to 12 in., and allowed to mellow during the winter. In the early spring the area should be surface-cultivated or shallow-ploughed and brought to a fine tilth, with a well-firmed soil and a fine seed-bed. Good preliminary cultivation is a long step towards success and economy in growing the beet crop.

Seeding and Fertilizing.

Seeding should immediately follow the final cultivation of the seed-bed, in order that the weeds may have no advantage over the beet-seed.

If the soil is dry, free, and warm, sow on a rolled surface; if moist and disposed to cake, plant on a harrowed surface about ½ in. deep for early sowings,

and deeper for the late sowings. Sometimes growers plant the seed very deep in loose soil, and generally secure a slow, thin, unsatisfactory germination. A special four-row beet-seed drill is used, with rows 18 in. or 20 in. apart, the most favoured widths for yield of sugar per acre. About 12 lb. of seed is sown per acre, because it is necessary to secure a rapid, strong germination, the germinating seeds helping one another through. The Maffra district is generally warm and fairly early, so that some plantings may be made, if the weather conditions are favourable, as early as July, but very early plantings are liable to run somewhat to seed, with a consequent loss in sugar-content. August plantings are considered early, September normal, and October–November plantings late.

Superphosphate is drilled in beforehand or with the seed, and has consistently proved beneficial to the growth of the plant without disturbing the sugar-content and purity of the beets. The quantities used locally range from ½ to 2 cwt. per acre.

The well-farmed soils in this district seem to have plenty of nitrogen available, and it is no advantage to unduly force the growth of leaves to the detriment of the roots. The beet uses up a quantity of potash, which seems to be sufficiently plentiful in this district, but would probably have to be added in the form of sulphate of potash in most well-established beet areas. By ploughing-in the beet crowns and tops a great part of the plant-food absorbed by the beets may be restored to the soil. Beets thrive in well-limed soils, but growers have not yet seen fit to use the mill-waste lime as freely as they should.

Tillage.

Early plantings should germinate in a fortnight, late plantings in a week, and directly the rows are defined the area should be rolled and followed by four-row beet-cultivators fitted with special sweeps that will cut very close to the rows without disturbing the beets. This first cultivation can hardly be done too early, and is most important in checking the weeds, giving the beets a strong, clear start, and making the thinning-conditions easy and economical. The growers who neglect or delay their first cultivation almost invariably pay dearly for it subsequently. The intertillage is not costly, as a four-row machine will comfortably do 10 acres a day, and should be applied after thinning and after rain as frequently as necessary to keep the soil in the best condition and free of weeds.

Thinning and Side-hoeing.

Beet-thinning is the principal hand-work, and is done by casual labour on contract. As a rule it is best for the grower to devote his own time to the cultivation work, and have the thinning done quickly by contract labour at the ruling rates.

Thinning should be done soon after the first cultivation, and commenced while the beets are quite small, as young beets are easier to thin than forward beets, and such thinning is more satisfactory for the contractor. Furthermore, if delayed, the weeds soon develop, and the beets get overstrong and are difficult to handle, thereby adding to the cost of thinning. The absorption of moisture by a full stand of beets allowed to remain too long unthinned is a heavy pull on the soil, and will invariably reduce the yield of beets to a tonnage considerably below those sections thinned at the correct period. Experience and costs have repeatedly shown that it is better to err on the early side than on the late side when thinning beets.

Thinning is done with short-handled hoes to space the beets. The left hand of the operator is free to thin the beets to a single strong plant at distances approximately 8 in. in very rich, moist soils, 10 in. in good beet-soil, and 12 in. in medium or drier soils. Many thinners become very expert at the work, and do as much as half an acre and sometimes more per day.

The development of single-germ seeds would be a great advantage to thinning, and check-row planting a possible improvement.

Side-hoeing is done with long-handled hoes a few weeks after thinning to remove all weeds growing in the rows, the cultivator destroying everything between rows. Side-hoeing is frequently done by contract, at prices varying according to the cleanness or otherwise of the crop. Beet-thinning and side-hoeing are in process in the Maffra district from August to December.

(To be continued.)

STOCK SLAUGHTERED, 1919–20.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary slaughterhouses throughout the Dominion during the year ended 31st March, 1920:—

——	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	102,714	256,459	..	54,033	413,206
Calves ..	22,692	9,377	..	2,302	34,371
Sheep ..	604,708	4,658,897	..	248,877	5,512,482
Lambs ..	114,946	3,139,238	..	26,417	3,280,601
Swine ..	53,886	38,043	23,296	25,520	140,745

In addition to the above, 24,424 pigs killed and dressed by farmers were inspected at butchers' shops.

LAND FOR RETURNED SOLDIERS.

THE lands at present notified to be opened in the various districts in October are: Auckland—Matamata North Block, of 360 acres, subdivided into five sections; Hawke's Bay—Paremata Settlement, of 998 acres, subdivided into six sections; Southland—Strathvale Settlement, of 838 acres, subdivided into nine holdings. It is also anticipated that several other estates purchased for closer settlement will be thrown open for selection in October, or early in November, the principal blocks being situated in the Canterbury District. The main features of the lands to be opened for selection during the current September were published in last month's *Journal*.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Napier, 20th and 21st October, 1920.
Marlborough A. and P. Association: Blenheim, 26th and 27th October, 1920.
Poverty Bay A. and P. Association: Gisborne, 26th and 27th October, 1920.
Wairarapa and East Coast A. and P. Society: Carterton, 27th and 28th October, 1920.
Canterbury A. and P. Association: Christchurch, 11th and 12th November, 1920.
Manawatu and West Coast A. and P. Association: Palmerston North, 3rd, 4th, and 5th November, 1920.
Wanganui Agricultural Association: Wanganui, 17th and 18th November, 1920.
Banks Peninsula A. and P. Association: Little River, 23rd November, 1920.
Thames Valley A., P., and H. Association: Te Aroha, 24th and 25th November, 1920.
Auckland A. and P. Association: Auckland, 3rd and 4th December, 1920.
Southland A. and P. Association: Invercargill, 14th and 15th December, 1920.
Woodville A. and P. Association: Woodville, 25th and 26th January, 1921.
Feilding I., A., and P. Association: Feilding, 1st and 2nd February, 1921.
Clevedon A. and P. Association: Clevedon, 5th February, 1921.
Otago A. and P. Society: Dunedin, 9th and 10th February, 1921.
Northern Wairoa A. and P. Association: Aratapu, 19th February, 1921.
Franklin A. and P. Society: Pukekohe, 25th and 26th February, 1921.
Morrinsville A., P., and H. Society: Morrinsville, 9th March, 1921.
Temuka and Geraldine A. and P. Association: Temuka, 7th April, 1921.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)